MECHANICAL ENGINEERING

• MARCH 1951 •

Changing Patterns of Fuel Supply . . . . . *James Boyd* 189

The Fields of Utility of Investment Castings . . . . . *R. L. Wood and D. Von Ludwig* 191

Radiation Pyrometry in the Steel Industry . . *Donald Robertson* 198

The Application of Cutting Fluids to Machining Operations . . . . . *R. B. Niebusch and E. H. Strieder* 203

A Businessman's Responsibilities in Rearmament . . . . . *E. L. Lindseth* 208

Plastics Literature References . . . . . *H. M. Richardson* 211

Planning Your Future . . . . . *T. A. Marshall, Jr.* 216

Departments

Briefing the Record, 219
ASME Technical Digest, 233
The Engineering Profession—News and Notes, 253
ASME News, 267
Keep Informed, Adv. Page 41

ASME SPRING MEETING — Atlanta, Ga., April 2-5, 1951

Could You Use SAVINGS *Like These?*

40% less
Fuel Consumption
50% more
Boiler Capacity

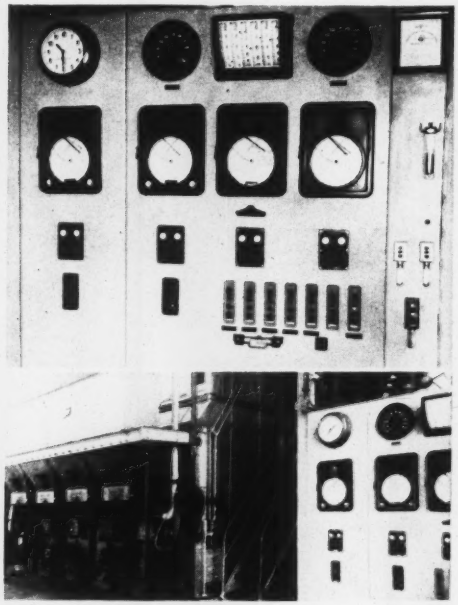
Bailey Meters and Controls Insure Savings at Kerr Bleaching & Finishing Works, Concord, N. C.

The key to complete returns on any investment in new power equipment is a fully co-ordinated system of meters and controls. It's the old story, the tail that wags the dog—careful attention to this comparatively minor part of the over-all installation cost can mean the difference between profit and loss in operation.

Here's where Kerr Bleaching & Finishing Works has cut operating costs—by installing *co-ordinated* Bailey Meters and Controls. The installation includes Bailey Meter Combustion Control, and Bailey Two-element Feed Water Control.

Such a co-ordinated system is an important plus for Bailey customers. Nowhere else can you buy such a complete range of equipment, selected without bias to do the best job for you. Nowhere else can you find such expert engineering service, immediately available through conveniently located direct sales and service representation. May we help you?

Call our local branch office or write for Bulletin 15-H. A-113



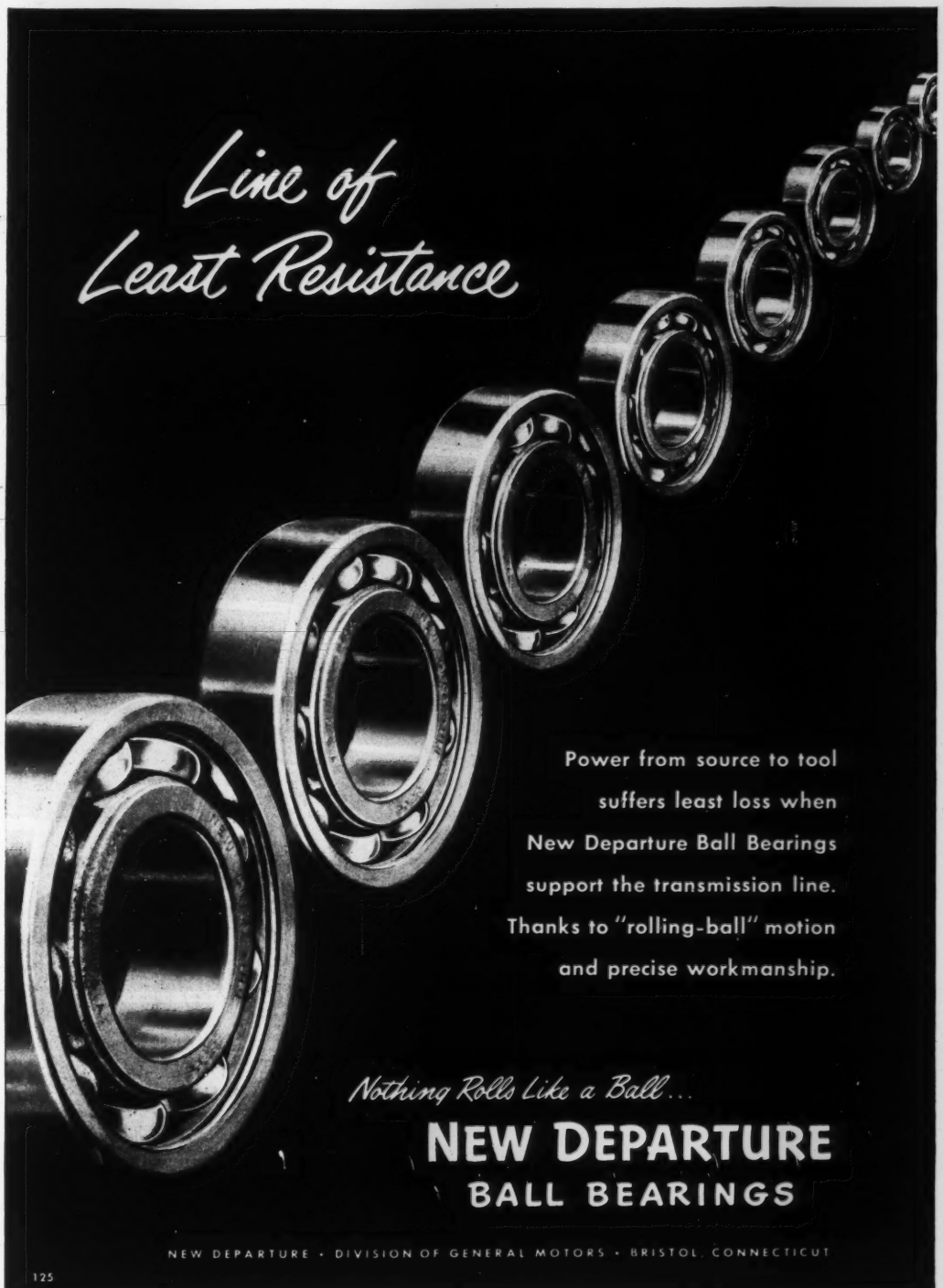
Control panel, showing completely co-ordinated Bailey Meters and Controls at Kerr Bleaching and Finishing Works, Concord, N. C.

BAILEY METER COMPANY

BAILEY METERS

1026 IVANHOE ROAD
CLEVELAND 10, OHIO

Controls for Steam Plants
COMBUSTION · FEED WATER
TEMPERATURE · PRESSURE
LIQUID LEVEL · FEED PUMPS



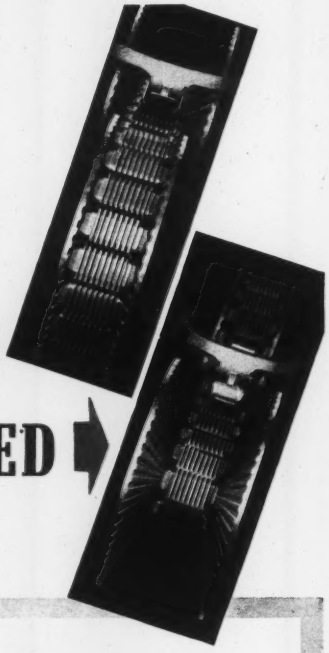
MECHANICAL ENGINEERING, March, 1951, Vol. 73, No. 3. Published monthly by The American Society of Mechanical Engineers, at 20th and Northampton Sts., Easton, Pa. Editorial and Advertising departments, 29 West 39th St., New York 18, N. Y. Price to members and affiliates one year $3.50, single copy 50¢; to nonmembers one year $7.00, single copy 75¢. Postage to Canada, 75¢ additional, to foreign countries $1.50 additional. Entered as second-class matter December 21, 1920, at the Post Office at Easton, Pa., under the Act of March 3, 1879. Member of the Audit Bureau of Circulations.

For Editorial Contents See Page 185

Only the P.I.V. variable speed drive has tooth-grip action . . . from

MAXIMUM SPEED to MINIMUM SPEED

with an infinite number of positive settings

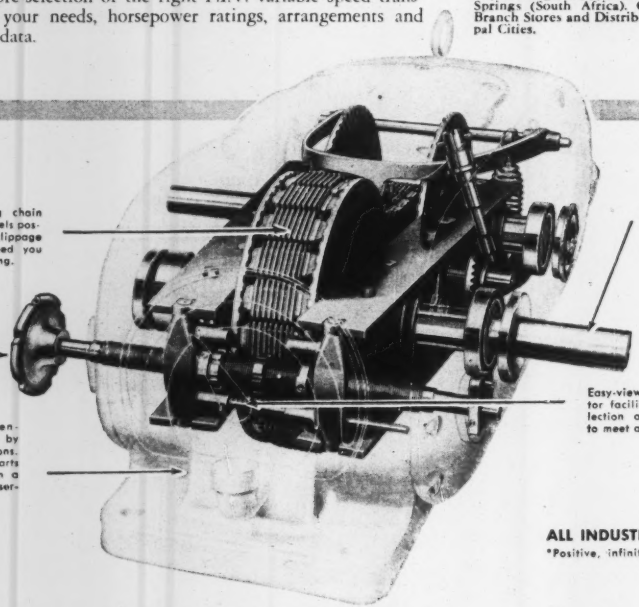


Only Link-Belt's P.I.V. delivers *positive*, stepless speed changing independent of friction . . . because only Link-Belt's P.I.V. has the self-tooth-forming chain that makes this possible. Your nearest Link-Belt branch office can show you how to increase the efficiency and flexibility of your machines, and supply complete information —covering pre-selection of the right P.I.V. variable speed transmission for your needs, horsepower ratings, arrangements and engineering data.

LINK-BELT P.I.V. VARIABLE SPEED DRIVE

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices, Factory Branch Stores and Distributors in Principal Cities.

12,293



Self-tooth-forming chain grips toothed wheels positively without slippage — gives the speed you need at any setting.

You can get minute speed changes and maintain them accurately while operating under full load.

An infinite number of positive, stepless speed adjustments may be made with manual, electric, pneumatic or hydraulic controls.

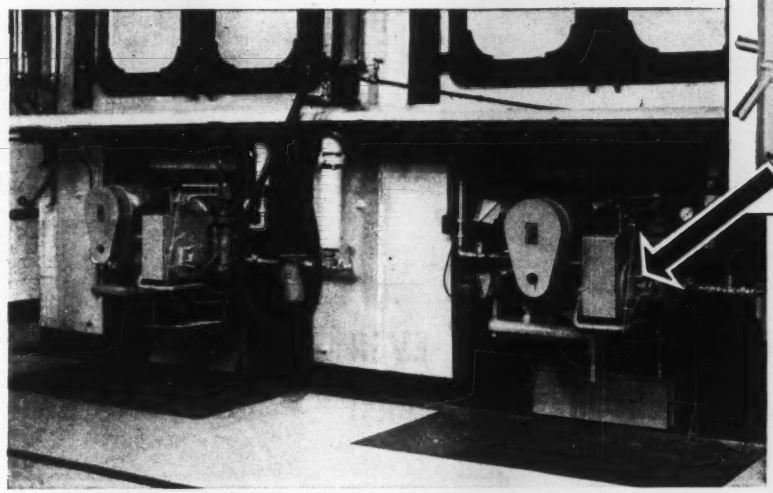
Easy-view speed indicator facilitates speed selection and adjustments to meet all requirements.

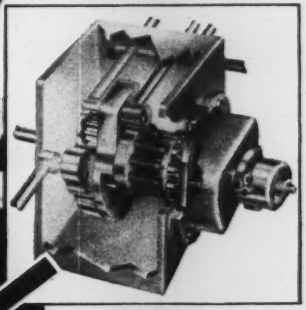
All-metal, totally enclosed — unaffected by atmospheric conditions. All vital operating parts splash-lubricated from a common housing reservoir.

ALL INDUSTRY USES P.I.V.*

*Positive, infinitely variable

The Modern way to fire heavy oil





Iron Fireman Oil Volumeter *feeds oil in uniform volume regardless of viscosity*

The Iron Fireman Oil Volumeter is a variable volume pump which is completely submerged in the oil reservoir. Multiple pistons operating in a rotating cylinder-block pump the oil to the rotary cup nozzle under *low pressure*. Volume of oil delivered is regulated *accurately* by the length of the piston stroke, which is easily controlled either by automatic control systems or by manual adjustment. Oil feed rate stays within ½ of 1% of setting, regardless of changes in oil viscosity.

Iron Fireman Rotary Oil Burner

fires heavy fuel oils with steady, uniform flame

The Iron Fireman Horizontal Rotary oil burner handles all grades of oil—from lightest to heaviest—with accuracy and precision. The Oil Volumeter meters the oil to the nozzle by *volume*—not by the old-fashioned methods of viscosity compensating valves or adjustable ports. This precision feed results in a steady, uniform flame, even when throttled down to less than 20% of capacity. Dependable oil flow results in thorough reliability even when starting up in a cold boiler.

The heavy fuel oils (Nos. 5 and 6) are lower priced than ordinary burner oils, yet they may contain up to 12% more Btu's per gallon, as compared with lighter oils. Thus, with the precision firing of these heavy oils you save in two ways — in the cost per gallon and the amount of heat obtained per gallon.

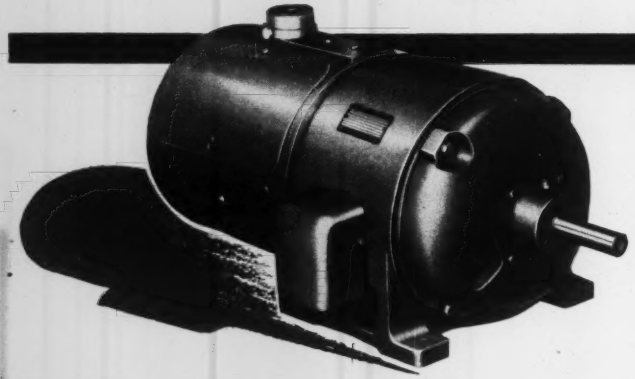
For further information write for new 16-page booklet, "The Iron Fireman Horizontal Rotary Oil Burner." Address Iron Fireman Manufacturing Co., 3148 West 106th Street, Cleveland 11, Ohio. Other plants in Portland, Oregon; Toronto, Ontario. Dealers everywhere.

THE IRON FIREMAN

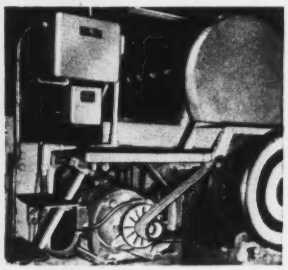
IRON FIREMAN

AUTOMATIC FIRING EQUIPMENT FOR OIL, GAS, COAL

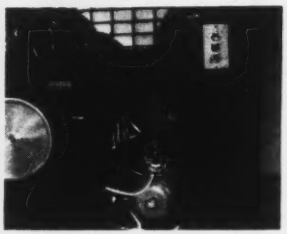
Designer's



ACA gear-motor—A single, compact unit designed for low adjustable speed—is easily controlled remotely by a motor-mounted pilot motor. Here, three ACA gear-motors drive a junior bleach range in a textile mill.



D-c magnetic stopping brake is added to 10-hp ACA motor driving a flatbed letterpress. Motor starter is in upper case. Excitation panel in lower case provides adjustable stopping torque for brake. All control is press-mounted.



Speed pre-setter, on this 3-hp ACA motor driving an offset press, automatically trips and slows motor in case of faulty feed. After feed has been adjusted and trip lever reset, press quickly accelerates to pre-set speed automatically.

NOW- MORE VERSATILE THAN EVER to meet more of your design needs!

ACA A-C ADJUSTABLE SPEED MOTORS

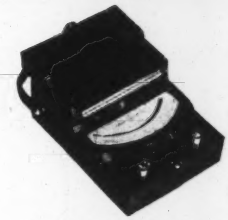
Simplest, lowest-cost way to get stepless adjustable speed directly from a-c power is with the General Electric Type ACA motor. Now—to increase its already inherent versatility—new optional features and modifications have been developed, enabling it to meet even more of your specialized design needs. They include standard gear unit for low adjustable speed, Warner magnetic brake, pilot motor for remote control, simplified control without speed-regulating secondary resistors, and fixed-speed pre-setter—mechanical or electrical—with trip-slowdown provision. All but the control are motor-mounted.

New applications for the ACA motor with speed pre-setter, for example, include offset printing presses, bindery machines, planer-feed-roll drives, punch presses, fan drives, can-sealing machines, conveyor drives, mixers, and many others. For any specific design application *you* may have in mind, more data will be supplied gladly. Meanwhile, send for Bulletin GEA-4883 on ACA motors. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

Digest

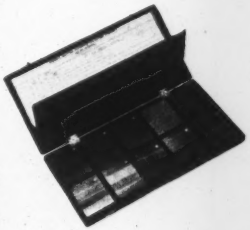
PRODUCT HIGHLIGHTS



PORTABLES ON PARADE!

Handy review of measuring instruments

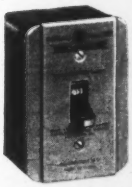
Now General Electric makes it easier for you to select the measuring instruments you need for field-testing products, for research work, and for checking your machines' performance. Here, in one comprehensive new 48-page book, is a condensed guide to all G-E portable instruments for a-c and d-c measurements. Contents, arranged for easy reference, give full information on each type, including uses, accuracies, dimensions, scale-marking data, construction details, and list prices. See Bulletin GEA-1784.



STANDARD- OR POCKET-SIZE!

Surface roughness scales

Assure the uniformity of machined surfaces, especially on parts made by several subcontractors or different plant departments, by means of General Electric surface roughness scales. A quick, easy way for machine operators and inspectors to check surface finish by sight and feel, it eliminates unnecessarily fine finishes, reduces rejects due to insufficient finishing. Available, in addition to the standard set shown (see Bulletin GEC-572), is a pocket-size version (see Bulletin GEC-311).



FOR USE ANYWHERE!

Fractional-hp manual switches

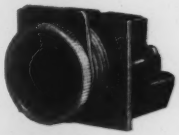
Here's a small, compact switch—as simple as the one that snaps on your home lights—that incorporates long-life, easy-installation features most wanted by industrial users. It's General Electric's hand-operated motor-starting switch for fhp motors, made for mounting on or near all types of machines, for use practically anywhere. Enclosures include general-purpose, dust-tight, water-tight types, plus types for hazardous areas. Thermostatic bi-metallic strip and heater provide positive overload protection. See Bulletin GEA-2234.

When push-buttons are "built-in"—Specify

G-E UNITS FROM A WIDE RANGE

Remember this when your product design calls for just the right "built-in" finishing touch: General Electric makes a push-button unit for almost every purpose! Available are general-purpose and oiltight units, standard-duty and heavy-duty types, front-connected and back-connected wiring, and extra-long, mushroom-type or illuminated buttons. To widen your possible combinations, you can choose from single- or double-pole units, single- or double-throw contacts, and a variety of selector switches, indicating lights, and interchangeable nameplates. See Bulletin GEA-4254.

Single-pole, double-throw, general-purpose push-button unit



Single-pole, double-throw, oiltight push-button unit

Single-pole, double-throw, general-purpose selector switch

Heavy-duty indicating-light unit with built-in resistor

General Electric Company, Section K 668-87
Apparatus Department, Schenectady 5, N. Y.

Please send me the following bulletins:

- ☑ for reference purposes
- ☒ in connection with immediate projects

- ☐ **GEA-1784** Portable instruments
- ☐ **GEA-2234** Manual fhp switches
- ☐ **GEA-4254** Push-button units
- ☐ **GEA-4883** ACA motors
- ☐ **GEC-311** Pocket roughness scales
- ☐ **GEC-572** Standard roughness scales

CONSULT YOUR McGRAW-HILL ELECTRICAL CATALOG FOR PRODUCT ENGINEERS! You'll find "everything electric" for machinery manufacturers in the General Electric section.

Name.....

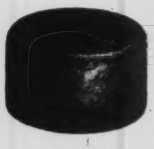
Company.....

Street.....

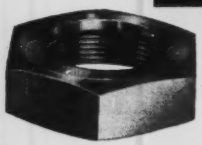
City..... **State**.....

Toothed Lock Washer: Prevents loss of stem nut due to vibration, thereby holding the handwheel securely.

Newly Designed Handwheel: Air-cooled, finger grip handwheel affords sure grip even with greasy gloves.

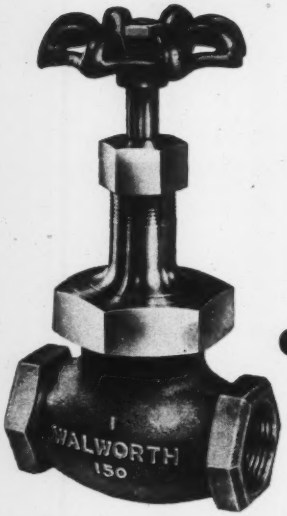


Improved Packing: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure.



Hexagonal Union Bonnet Connection: Eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and assembled.

WALWORTH



IMPROVED
No. 95
BRONZE
GLOBE VALVE

also available in Angle Type (No. 96)

The service ratings of the Walworth No. 95 are 150 pounds per square inch steam at 500F, and 300 pounds per square inch non-shock cold water, oil, and gas. In the manufacture of this quality bronze valve, more than 47 gages are used in machining parts to micrometric accuracy, thus insuring interchangeability of parts. For further information see your local Walworth distributor, or write: Walworth Company, 60 East 42nd St., New York 17, N. Y.

note these 7 Great Features

WALWORTH
valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

New Cylindrical Disc Holder: The design of the top portion of the disc holder keeps the disc accurately guided under all operating conditions.

Renewable Asbestos Disc: This disc is suitable for steam up to 500F and is resistant to oil, gasoline, and many chemicals at atmospheric temperatures. Discs for special services are available.

Extra Strong Body: Made of Composition M (ASTM B61) bronze thick enough to provide a high safety factor. Valves undergo hydrostatic shell test of 450 psi.

OILITE may relieve your shortage of critical materials

Particularly in mass-production units of small and medium size, Oilite finished machine parts and bearings can be made to your design in a broad range of ferrous and nonferrous metals and alloys, except as limited by government control. Moreover, Oilite products of ferrous base may serve excellently instead of scarce nonferrous units or as replacements for steel and castings.

When you employ Oilite you also obtain the benefits of more than 20 years' engineering, research, and production experience in powder metallurgy, together with the service of field engineers throughout the United States and Canada.

You are invited to contact the field engineer in your district or write the home office regarding the application to your needs of Oilite products.

AMPLEX MANUFACTURING COMPANY

Subsidiary of Chrysler Corporation

DETROIT 31, MICHIGAN

Field Engineers and Supply Depots in Principal U. S. and Canadian Cities

OILITE PRODUCTS

Heavy duty, oil-cushioned, self-lubricating bearings and finished machine parts in ferrous and nonferrous metals and alloys. Permanent filters. Friction units. Self-lubricating cored and bar stock.

A Note to Executives

Oilite is an effective replacement, not a mere substitute

In the last decade, more and more executives have become "Oilite minded" because the advantages are many. To meet the current situation, many of our customers have changed their specifications to replace strategic copper and tin with products of iron powder or iron powder alloys. Others are replacing iron castings, steel and aluminum with similar Oilite products.

Also of importance to executives, under conditions of urgency, are the wide adaptability, the speed of delivery, and the economy of cost, time and manpower which result from the use of Oilite finished machine parts, made from metal powders.

Intricate designs, which normally require many different machining operations, can be produced quickly and economically from Oilite. There is great freedom of design and frequently two or more parts can be combined in a single Oilite unit. Oilite eliminates up to 24 machining operations.

Delivered ready for assembly, Oilite parts save the time and investment required to tool up by standard methods. It is not unusual to be in production on a complex Oilite part within a few weeks, as compared to a possible 18-month delivery of machine tools. Trained manpower is thus released for other urgent needs.

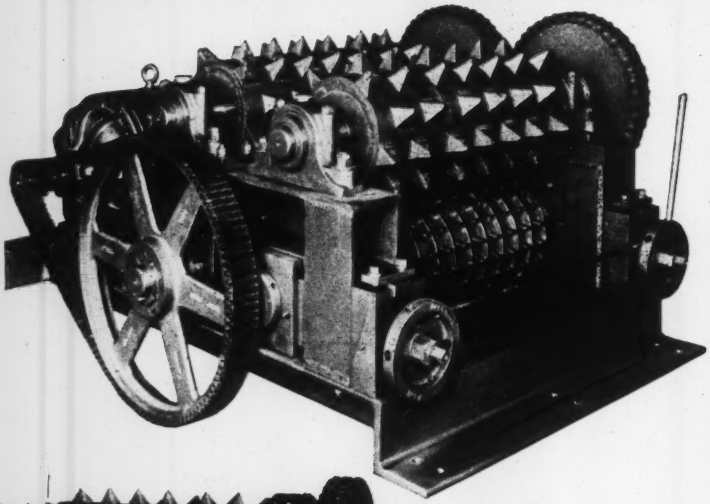
Oilite is not a substitute. It is metallurgy's answer to the need for a new material. It may solve your problem.

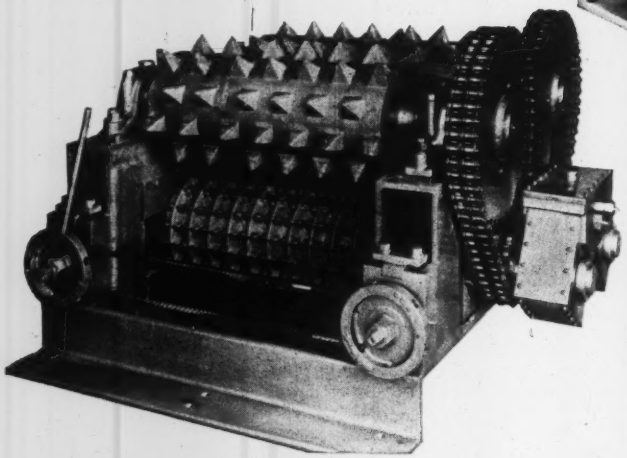
President

OILITE PRODUCTS

Powerful MORSE

Morse Silent Chain Drives maintain absolutely constant speed ratio. They are unaffected by atmospheric conditions or idleness. Morse Silent Chain Drives need but few adjustments to maintain tension, save valuable servicing and replacement time. The exclusive Morse Rocker Joint gives Morse Silent Chain Drives highest operating efficiency and longest possible life by substituting rolling for sliding action.



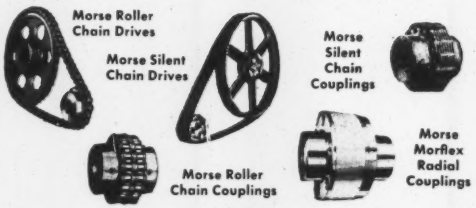


Precision-made Morse Roller Chain Drives use teeth, not tension. And that means positive power transmission. There is no slippage. Friction loss is slight, constant ratios are maintained. Morse Roller Chain Drives save space, operate equally well on short or long centers. They give extra-long, trouble-free life.

Ask the Morse Man for power transmission information!

100 Morse Branch Offices and Distributors to supply your power transmission demands.

From coast to coast there are more than 100 offices, representatives and distributors of Morse Power Transmission products to give you quick information and service when you want it—where you want it. *Ask the Morse Man first in any case!* Check your classified phone directory under **"Power Transmission"** or **"Chains"** for the nearest Morse Man.


Morse Roller Chain Drives
Morse Silent Chain Drives
Morse Silent Chain Couplings
Morse Roller Chain Couplings
Morse Morflex Radial Couplings

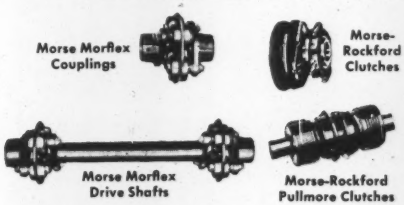
CHAIN DRIVES put the bite on coal...

THE Gundlach Two-Stage Coal Crusher reduces run-of-mine coal to stoker coal in one operation. Coal is gravity fed to heavy, tooth-studded roller-jaws, is broken, dropped to bottom rollers, crushed to correct size, carried away. Rugged Morse Chain Drives deliver this machine's powerful bite. A Morse Silent Chain Drive delivers maximum power from the motor and takes the heavy shock loads in its stride. Two Morse Roller Chain Drives in the ingenious power transmission system turn primary rollers. Controls connected by a Morse Roller Chain are operated by a single lever.

Morse offers a complete line of top-quality power transmission equipment. Turn to Morse to solve your power problems as Gundlach has. For complete information, write

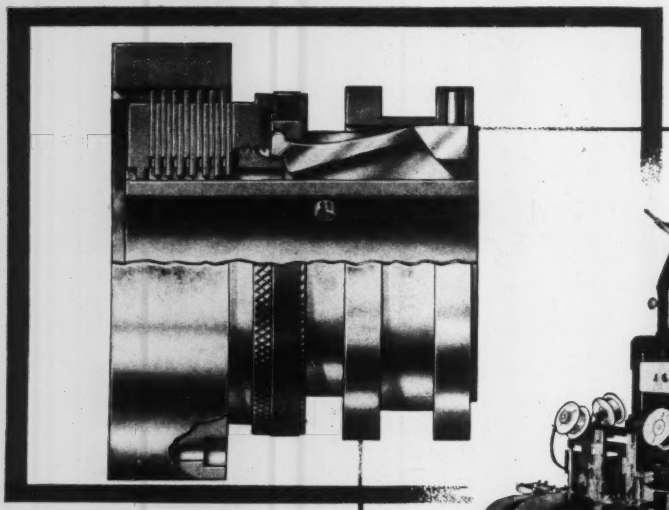
MORSE CHAIN COMPANY
Dept. 129 • 7601 Central Ave., Detroit 8, Michigan

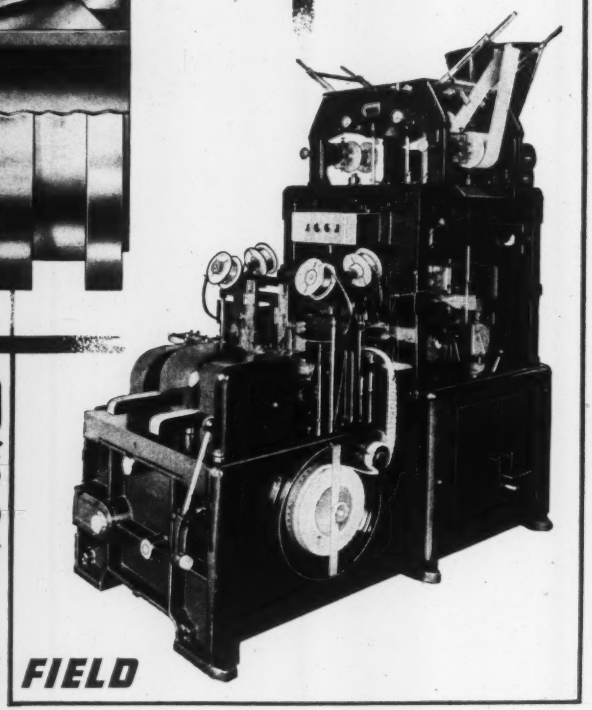
Morse *means* Power Transmission



MORSE
MECHANICAL *POWER TRANSMISSION* PRODUCTS

PRODUCTS OF BW BORG WARNER





MAXITORQ KEEPS GOOD COMPANY

..IN THE PACKAGING FIELD

Here's another "good company" friend of Maxitorq, the Pneumatic Scale Corp., that has selected our No. 23 Single Clutch as original equipment in their most ingenious Heat Seal Tea Bag Machines.

Automatically, at high speed, the bag material is fed from rolls, folded, crimped, filled with tea and sealed. Then tags are cut, attached to string, which is wrapped around the bag and stapled to prevent tangling. Such production requires a reliable, positive-acting clutch for smooth, uninterrupted operation.

The Maxitorq floating disc Clutch is made in 8 standard sizes from fractional to 15 H.P. at 100 r.p.m. Design is compact and streamlined . . . completely assembled on the body and shipped ready to slip onto a shaft. The floating disc feature (Separator Springs) prevents drag, abrasion and heating in neutral . . . and all Assembly, Adjustment and Take-apart are manual operations.

Carlyle Johnson engineers will provide practical solutions of your power distribution problems on request . . . and send you our new catalog covering single and double clutches, wet or dry . . . the automatic Overload Release Clutch and three styles of special driving cups.

Send for Catalog No. ME3

7C.150

THE CARLYLE JOHNSON MACHINE COMPANY
MANCHESTER • CONNECTICUT

. . . where there's processing involved there must be equipment. That calls for metal . . . and today many metals are hard to get.

But that needn't stand in the way of getting increased production. Many processors are finding that, whether they need old equipment modernized or new units built, a progressive equipment builder can solve the problem, save money and make the most effective use of critical metals.

One way such equipment builders protect their customers' equipment investment is the application of the *Lukenomics* principle. For Lukenomics combines their experience and that of designers and engineers with Lukens' specialized knowledge of materials and their application. For names of equipment builders applying this principle, write, stating your problem, to Manager, Marketing Service, Lukens Steel Company, 402 Lukens Building, Coatesville, Pa.

This packaging tank illustrates how applied Lukenomics benefits process industries. Fabricated for a food processor, the unit assures efficient handling of a powdered milk product for infants. Made of Lukens Nickel-Clad Steel, the tank's smooth inner nickel surface permits steady flow of powder to a conveyor packer. Maintenance has been greatly reduced, cleaning simplified and product purity easily maintained. Plain steel would have been unsuitable . . . solid nickel too costly. By using nickel-clad steel, the equipment builder reduced equipment cost and effected an 85% saving of critical metal.

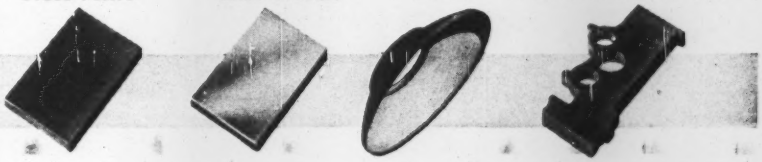
With the defense program's having first call, you'll understand why Lukens specialty steel products for civilian use are not so plentiful as in normal times.

LUKENS

LUKENS STEEL COMPANY

OVER 140 YEARS' EXPERIENCE AS THE WORLD'S LEADING PRODUCER OF SPECIALTY STEEL PRODUCTS

STEEL PLATE | CLAD STEELS | HEADS | STEEL PLATE SHAPES



679 SARCOS

WILL INSURE EFFICIENT HEATING IN NEW FORD BUFFALO PLANT

The new Ford pressed steel plant in Buffalo, N. Y., will have a floor area of 1,000,000 square feet and employ 3,500 people. To insure dependable and efficient heating, 327 Sarco Inlet Valves will be used on the hot water radiators; 215 Sarco Float-thermostatic steam traps on unit heaters, ventilators, blast coils and storage heaters, and 137 Sarco bucket traps for dripping and steam lines.

Wherever heat is used—in buildings, large or small—for hot water or any type of steam heating—you will find a chance to save three ways with Sarco. You save production time by having continuous, reliable heat —no cold blasts of air, for instance, when condensate is removed continuously by the Sarco float-thermostatic trap. You save in maintenance because of the well-known long life characteristics of Sarco products. And, you save fuel because a system that is efficient converts every dollar's worth of usable steam into usable heat. Ask for the Sarco bulletins on steam traps and controls for heating systems.

Ask for the Sarco Bulletins on Steam Traps and Controls and Heating Systems

329

SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 8, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

Seamless brass tube—having end spun—constitutes this percussion primer tube blank

Percussion primer tube-body blanks can be produced in a jiffy here at Wolverine by the well-known Spun End Process*, which is used to form the end.

These fabricated blanks can be furnished by us to prime contractors who then just need to drill or punch the holes along the length of the tube, face to length, and ream and tap.

We are equipped to fabricate these blanks of other metal besides brass.

We invite prime contractors to give consideration to the many advantages presented by this fast, efficient, accurate process used for forming products of this type out of Wolverine seamless tube.

Our Customer Engineering Service will be glad to give you any assistance you may require in setting up the production of essential parts requiring ends that must be entirely or partially closed.

*a patented process RE: 22465

WOLVERINE TUBE DIVISION
Calumet & Hecla Consolidated Copper Company
INCORPORATED
Manufacturers of seamless non-ferrous tubing
1437 CENTRAL AVENUE • DETROIT 9, MICHIGAN

PLANTS IN DETROIT AND DECATUR, ALA.
Sales Offices in Principal Cities

EXPORT DEPARTMENT, 13 E. 40th St., New York 16, N. Y.

Looking for trouble before it starts...

with an MB VIBRATION EXCITER

One of the many instruments produced by the Sperry Gyroscope Company is here undergoing a "shake test" on the MB model S-3 Vibration Exciter. Such vibration testing contributes to the dependability in service for which Sperry instruments are noted. The instrument is fastened to the shake table of the exciter, which is controlled from panel. Amplitude, velocity and acceleration are being read directly on an MB Vibration Meter.

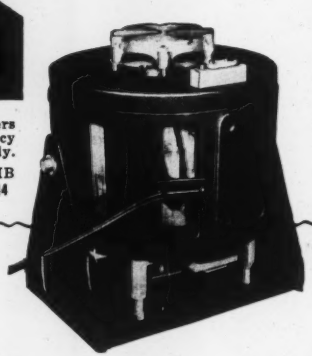
WHEN PRODUCTS GIVE unexpected trouble in service, you'll find too often that it's due to vibration.

Foresighted concerns take no chances with this enemy of equipment life. At Sperry Gyroscope Company, possible troubles due to vibration are ferreted out in the laboratory. By means of an MB Vibration Exciter, which has quick, easy adjustments for force and frequency, instruments are checked for vibratory response – for ability to resist fatigue. Result: Trouble is eliminated in the design stage, *before* it starts.

This shaker is adaptable to countless situations. You can test miniature electrical assemblies to mammoth wing structures; filaments to heavy axle shafts. In one of its jobs – fatigue testing – the shaker reproduces vibratory effect of years within hours. One company, for example, reduced the time of spot-checking bellows to 10 minutes – a job which formerly took 12 hours per unit!

Location of noise sources . . . actual observation of the motions of vibrations . . . study of damping characteristics of materials . . . these are but a few other important jobs where an MB Exciter pays off.

Models which deliver forces of 5, 25, 50, 100, 200, 300 and 2500 pounds are available – all electromagnetic. These exciters are suitable for vibration testing equipment to USAF specifications 41065-B and MIL-E-5272. Write us for details.



The Model 53 Vibration Exciter illustrated delivers peak force of 200 pounds. Operates in frequency range of 3 to 500 C.P.S. Has rotating power supply.

Write us for more detailed information on MB Vibration Exciters, and ask for **bulletin 418-M4**

THE MB MANUFACTURING COMPANY, Inc.

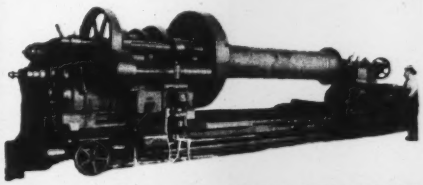
1060 State Street, New Haven 11, Conn.

PRODUCTS AND EQUIPMENT TO CONTROL VIBRATION . . . TO MEASURE IT . . . TO REPRODUCE IT

POSEY'S STEEL PLATE STORY *in a Nutshell*

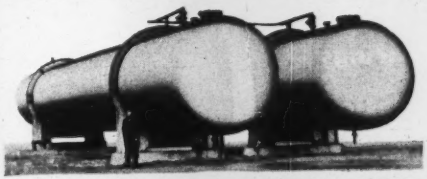
Posey's engineering department is staffed by men with long *practical* experience whose knowledge of shop requirements help end delays.

SKILLED ENGINEERING



Extensive, modernized plant permits Posey Iron to meet both "special" and standard requirements with economy and *speed*.

UP-TO-THE-MINUTE EQUIPMENT



Posey equipment is often delivered with *performance* guaranteed. All standard codes are met with liberal allowance for safety.

GUARANTEED PERFORMANCE

POSEY IRON WORKS, Inc.

STEEL PLATE DIVISION — LANCASTER, PA.

TANKS . . . STACKS . . . GENERAL STEEL PLATE CONSTRUCTION

FRICTION PROBLEM?

There is a NICE answer!

FROM high quality, close tolerance "ground all over" Precision Ball Bearings. . . . .

TO low cost "unground" Ball Bearings of inexpensive design and construction.

Have you any Ball Bearing requirements on which we may quote? For complete information on the Nice Line write for Catalog No. 140.

NICE

NICE BALL BEARING COMPANY
NICETOWN · PHILADELPHIA · PENNSYLVANIA

IT ALWAYS PAYS TO SPECIFY

LADISH

Controlled Quality

PIPE FITTINGS

TO MARK PROGRESS

...you know they are in to stay

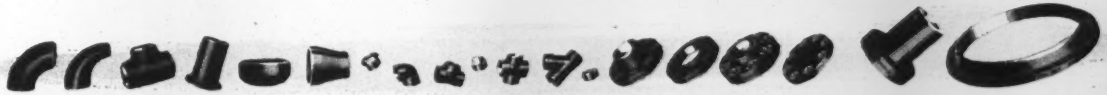
Long, trouble-free piping service results from extra safeguards in the manufacture of Ladish fittings. Rigid laboratory controls over chemical composition and physical properties of steel provide an assurance of maximum strength and resistance to erosion or corrosion. These are some of the extra safeguards for dependable operation which you always get in greatest measure in Ladish Controlled Quality Fittings.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

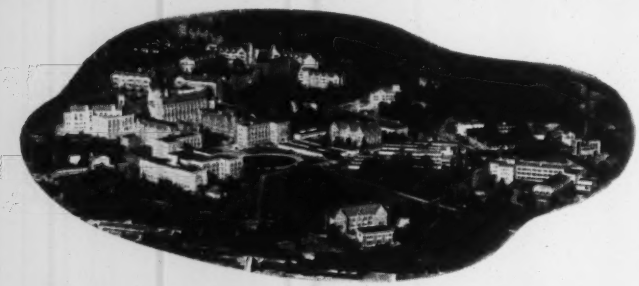
LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • Havana • Toronto • Mexico City



American Blower . . . a time-honored name in air handling



In Seattle, a leading university, as well as commerce, industry and public utilities, have made use of American Blower's Branch Office by calling Seneca 5860. To contact the American Blower Branch Office in your city, consult your phone book.

PLEASANT IDEA . . .

In Seattle, as in your home town, apartment house owners realize that invigorating, fresh air indoors can do much to attract desirable tenants. American Blower Utility Sets do just this. The Utility Set is ideal for general ventilation where duct systems are required. It can be used as a supply or exhaust fan and is equipped with Aileron Control for regulation of air flow. They're available as standard packaged units ready for immediate installation. Is there an idea here for you?

PROFITABLE IDEA . . .

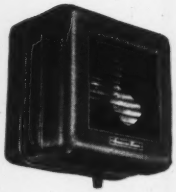
Fuel savings alone often will pay for a new heating system when you replace obsolete equipment with American Blower Unit Heaters. For example, a manufacturer of specialty equipment investigated and found he could convert his whole plant to unit heaters and pay for the system in 3 years with the fuel savings alone. American Blower carries a complete line of Unit Heaters, including gas-fired models and models for steam or hot water heating systems, wall- or ceiling-mounted.

FRESH IDEA . . .

We know an advertising agency in one of our larger cities that recently moved their offices into one of those beautiful old homes along the river. The ventilating system was adequate for a family, but converting it for commercial use posed some problems. But American Blower equipment solved them nicely. For example, smartly-styled Aeropel Fans now keep the conference rooms pleasantly fresh, Utility Blowers ventilate rest rooms, and Ventura Fans handle the large work areas. End result, they say—fresh air fosters fresh ideas.

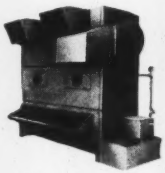
MAY WE SERVE YOU?

American Blower heating, cooling, drying, air conditioning and air handling equipment can do much toward improving comfort and efficiency in your business. For data, phone or write our nearest branch office.

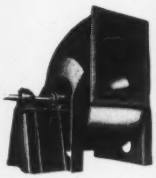


Unit Heaters

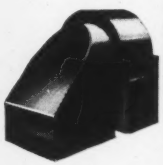
Ventura Fans



Air Conditioning Equipment



Industrial Fans



Utility Sets

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
WEST COAST PLANT: SAN LEANDRO, CALIFORNIA

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

YOUR BEST BUY AMERICAN BLOWER AIR HANDLING EQUIPMENT

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

HERE'S PROOF

FAST'S COUPLINGS cost you less to own and operate

ON BILLET MILL SINCE 1923

ON GAS BLOWER SINCE 1920

ON AMMONIA COMPRESSORS SINCE 1922

Fast's Couplings cost you less per year because they normally outlast the equipment they connect. That means their reasonable cost can be spread out over 20 years or more . . . assuring low-cost service without excessive maintenance costs!

Fast's basic design is *foolproof!* Instead of a perishable oil seal, Fast's are the only couplings to use a *permanent* metal-to-metal closure. Oil is always maintained at a safe level . . . whether the coupling is running or standing still . . . and dirt cannot get in. Fast's Couplings are compact, yet large enough to stand up under punishing service for 20 years or more!

When you specify Fast's Couplings, you get Koppers' valuable engineering service. In many cases where a special coupling appears necessary, Koppers engineers can modify a standard Fast's and save you money! Get the facts on Fast's Couplings. Mail the coupon for your copy of Fast's *free* Catalog today!

Mail Coupon for FREE Catalog

KOPPERS CO., INC., Fast's Coupling Dept.,
253 Scott Street, Baltimore 3, Md.

Gentlemen: Send me Fast's Catalog which gives detailed descriptions, engineering drawings, capacity tables and photographs.

Name.....

Company.....

Address.....

City.....Zone.....State.....

KOPPERS

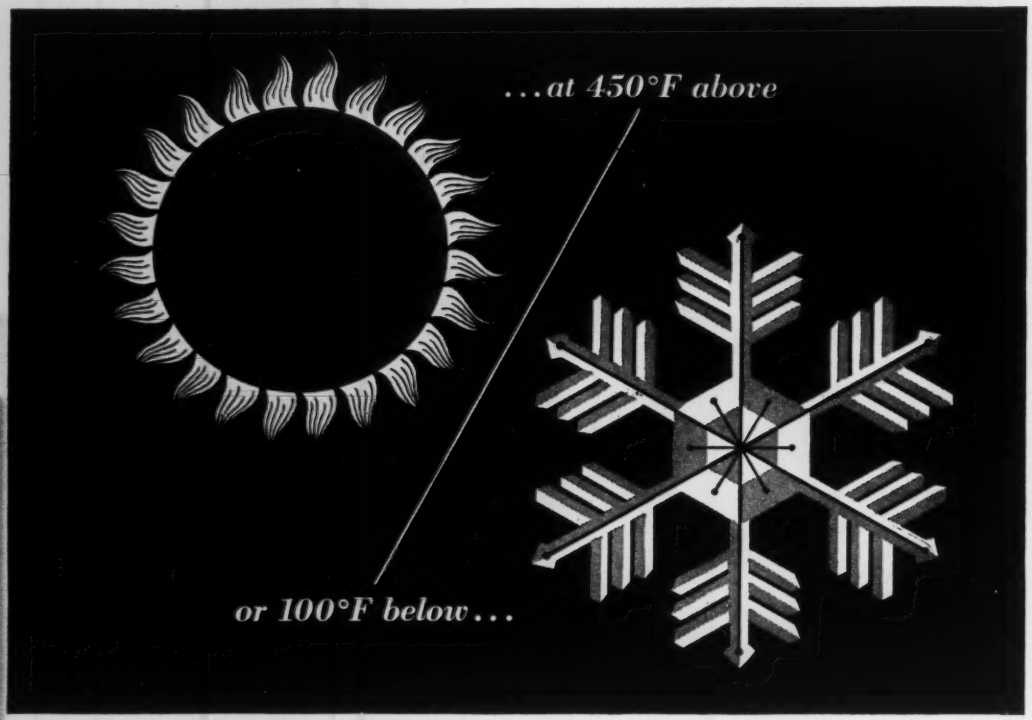
FAST'S

THE ORIGINAL GEAR-TYPE

Couplings

INDUSTRY'S STANDARD FOR 31 YEARS

Cellular Rubber that Works*



* *Silicone Spongex* Stock 9727

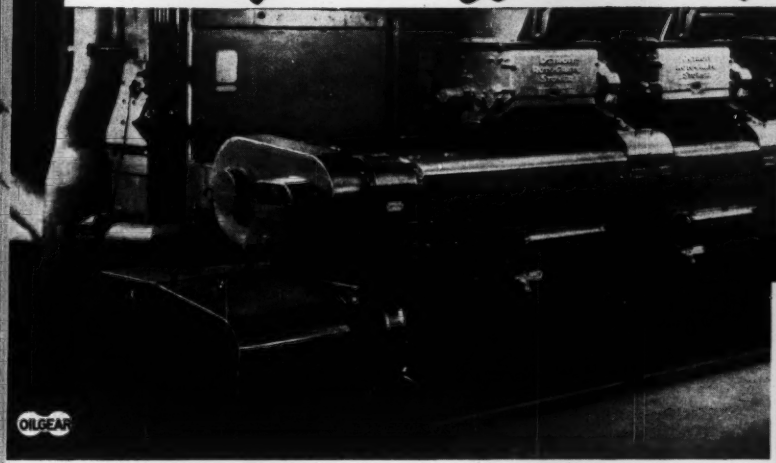
Is your product headed for altitudes never reached by commercial aviation? For climates where refrigerators, television sets and pleasure cars refuse to function? And on top of that . . . must you have insulation against shock, sound and vibration or against the passage of dust, air, temperature or moisture? Such a product will need cellular rubber components.

In the range from the soft, porous *Spongex* used as an iron lung collar seal to the rigid, featherweight *Spongex Cell-Tite* used as a carburetor float may be found the answer to your problem. If not, we'll work it out for you.

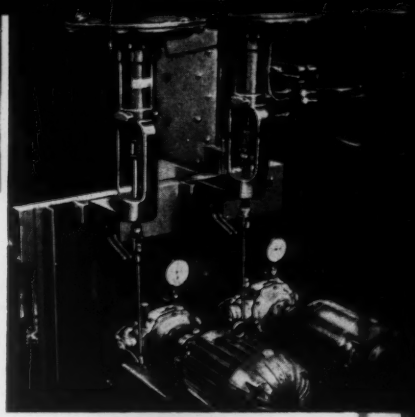
SPONGEX®
CELLULAR RUBBER

The World's Largest Specialists in Cellular Rubber
THE SPONGE RUBBER PRODUCTS COMPANY
401 DERBY PLACE, SHELTON, CONN.

"ONE OF THE *Highest Efficiency Units*" IN THE UNITED STATES



View in J. I. Case Co. tractor works at Racine, Wis. Boiler front and Detroit Rote-Grate Stoker on 100,000 lb. per hr. boiler unit.



Two Oilgear Variable Delivery Pumps with simple diaphragm actuated hydraulic servomotor lever controls supply fluid power for the fuel feed and grate drives. An Oilgear drive was experimentally installed on the fuel feed on the first stoker in 1948. On the basis of its performance, Oilgear drives were used for *both* fuel feed and traveling grate on a second stoker unit installed in 1949. Also, Oilgear will replace the mechanical grate drive on the first stoker installed in 1943. Like a shadow, flexible, controllable Oilgear *Fluid* Power causes fuel feed rate and grate speed to accompany steam demand up and down. Recording charts show steam *demand* varies "all over the place," but steam pressure and fuel air ratio stay steady.

And Oilgear's Range and Control help capture savings hidden in J. I. Case 100,000 lb. Boiler Unit

The 100,000 lb. per hour boiler unit in the J. I. Case Co. tractor works at Racine, Wisconsin, has demonstrated that it is one of the highest efficiency units in the United States. To obtain such high efficiency, careful tests of variable speed drives for fuel feed and grate travel were made during two years. Finally, Case engineers selected Oilgear Fluid Power Drives, for, as Mr. Cole H. Morrow, Chief Plant Engineer says, the Oilgear units proved far superior to electric drives and mechanical transmissions under actual operating conditions.

SMOOTH, POSITIVE SPEED VARIATION "In order to obtain high efficiency in any boiler unit," says Mr. Morrow, "*a very precise variable speed fuel feed drive* is required to meet widely varying demand. The Oilgear Drive gives smooth, positive variable speed operation from zero to 100% of capacity with a straight line fuel feed characteristic. This allows us to calibrate the control system for operation within amazingly close limits of fuel-air ratio variation.

EASE OF CONTROL "Also, on this type of stoker the grate speed must be infinitely variable from minimum to maximum yet maintained in direct proportion to the rate of fuel feed. Every change in fuel feed requires an immediate and directly proportionate change in grate speed. (Such synchronization) is easily obtained with the Oilgear drive units because of their ease of control, and the simplicity and low force requirements of the control mechanism."

UNLIMITED SPEED RANGE Also, fuel feed and grate drives must have a range of speed at least equal to the demand range. Most drives have a range not exceeding 4 to one. Yet at Racine, during the summer, demand drops far below the 25,000 lb. threshold imposed by such a ratio. The Oilgear Drives however have no "ratio" limits, would function down to zero load if necessary. In fact, they give precise load control down to a load of 15,000 pounds per hour normally obtained each day during the summer, and down to as low as 5,000 pph over the weekends still under full automatic control.

OUTSTANDING RELIABILITY "One of the outstanding features we discovered . . . was the *reliability of the Oilgear units*. The experimental installation operated almost continuously for a year and a half without any difficulty. This record was far better than we were able to obtain with any other type of drive or transmission."

These four features, variability, ease of synchronization and control, actual range from zero fpm, rpm or torque up to maximum, and reliability proven over and over again, are indications of the many advantages Oilgear drives and transmissions offer in machine design and use. Investigate Oilgear equipment as a *better* solution for your problems. THE OILGEAR COMPANY, 1570 West Pierce Street, Milwaukee 4, Wisconsin.

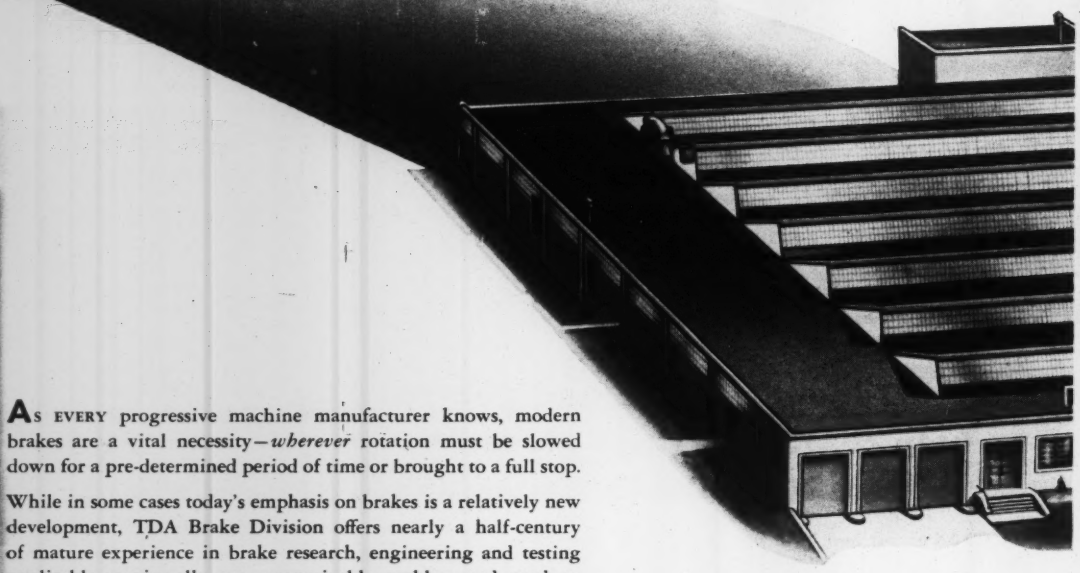
Oilgear

PIONEERS IN FLUID POWER
PUMPS, TRANSMISSIONS, CYLINDERS AND VALVES

WHATEVER YOUR BRAKING PROBLEM—

TDA BRAKE DIVISION

STAFFED AND EQUIPPED



As EVERY progressive machine manufacturer knows, modern brakes are a vital necessity—*wherever* rotation must be slowed down for a pre-determined period of time or brought to a full stop.

While in some cases today's emphasis on brakes is a relatively new development, TDA Brake Division offers nearly a half-century of mature experience in brake research, engineering and testing applicable to virtually every conceivable problem and product.

TDA Brake Division's highly specialized staff and fully equipped plant are completely set up to solve *your* specific braking problem—from the smallest machine to the largest crane or winch. TDA Brakes combine such outstanding features as positive stopping ability, faster, smoother operation, and reduced maintenance. Contact TDA Brake Division today! Or, if you prefer, write for more detailed information.

BEHIND THIS PLANT DESIGNING AND

Each of These Fields Has Its Own Distinct Brake Problems!

Centrifuges • Compressors • Conveyers • Cranes • Cream separators • Diesel hook-ups • Dry cleaning machinery Extractors • Hoists • Industrial electric trucks • Lathes (automatic) • Looms (textile) • Lumber mill machinery Machine tools • Materials handling equipment • Motors • Packaging machinery • Paint mixers • Press brakes Printing presses • Rolling mills • Shears • Warpers (textile) • Welding positioners • Winches • Automotive Farm equipment • Earth moving equipment • Construction equipment • Public transportation

IF ONE OF THEM IS YOURS, IT WILL PAY YOU TO

TAKE IT TO TDA BRAKE DIVISION!

THIS MODERN PLANT IS TO SOLVE IT!

• Every TDA brake model is run through exhaustive tests on brake dynamometers in this modern brake laboratory. Field tests are also performed on these rugged brakes under all operating conditions.

• The TDA Brake Division plant, located at Ashtabula, Ohio, has every modern machine for the manufacture of all types and sizes of brakes. Highly skilled workers reflect TDA Brake Division's more than 40 years' experience in the brake field.

STANDS MORE THAN 40 YEARS' EXPERIENCE IN BUILDING BRAKES FOR EVERY INDUSTRIAL USE!

TDA BRAKE DIVISION—DEPT. D
ASHTABULA, OHIO
Please mail brake information on these applications:

_____

_____

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

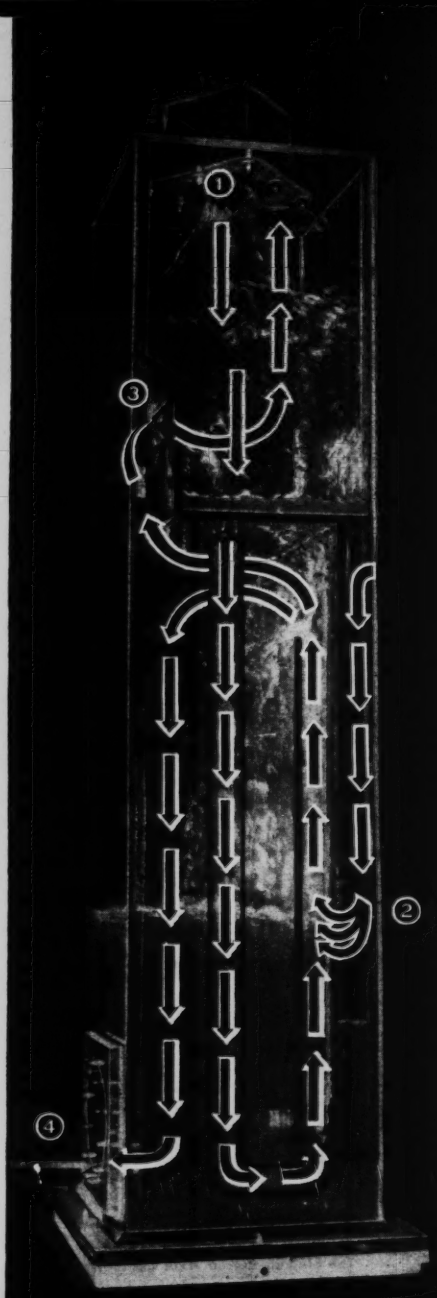
CITY _____ STATE _____

TIMKEN Detroit BRAKES

TDA BRAKE DIVISION
Ashtabula, Ohio
The Timken-Detroit Axle Company

The Accepted TDA Standard
TRADE MARK REGISTERED

ONE LOOK IS WORTH 1,000 GUESSES . . .



See for Yourself How the

PERMUTIT DEAERATOR

Removes All Oxygen and CO_2

This transparent model of Permutit's Deaerating Heater is a perfect picture of the operating ease and efficiency of the real unit it represents. Here are a few of the reasons why many engineers call it the best equipment for deaerating boiler-feed make-up water:

The Permutit Deaerator recovers waste heat economically, prevents corrosion of feed lines, stage heaters, economizers, and boilers, and is itself corrosion-free. It operates noiselessly and is adaptable to varying steam pressures. Above all, its simplicity of design insures a minimum of expense and attention for maintenance.

Write for full details to The Permutit Company, Dept. **ME-3**, 330 West 42nd Street, New York 18, N. Y., or to the Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

1. FIRST STAGE. Cold water, entering here, is heated almost to steam temperature by *spraying* it through steam. This removes 95% of the oxygen. The water then travels downward through the pipe toward the second stage.

2. SECOND STAGE. Here the partially deaerated water is intimately mixed with steam entering through the scrubber. Violent boiling and vigorous scrubbing is assured for both light and heavy loads, and deaeration is completed.

3. The steam from the scrubber travels upward and enters the first stage of the heater, where it partially deaerates incoming water. The remaining steam is then vented to the atmosphere.

4. Here the completely deaerated water settles and may be drawn off. Ample water storage space is provided below the water control level.

Water Conditioning Headquarters for Over 37 Years

PERMUTIT

We know it's no fun to wait for a BOILER

WICKES ENGINEERS appreciate the importance of hurrying up your boiler specifications, drawings, fabrication, installation and service.

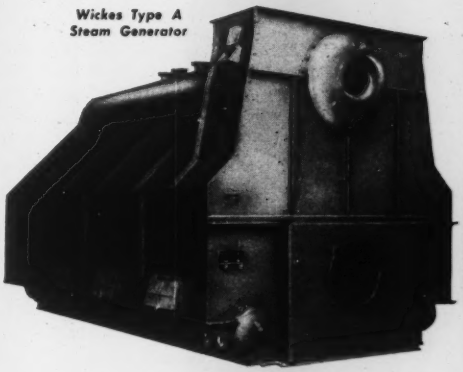
When you are planning the installation of a new steam generator, you naturally want service in a hurry . . . right from the time the first drawings are made 'til the day you raise steam pressure.

You get service from Wickes before the sale and after the installation. We're big enough to engineer the kind of job you need and give you the kind of service you want.

From the standpoint of boiler efficiency, too, it pays to call on Wickes. In fact, Wickes has been designing and building good, dependable, boilers since 1854.

Write or phone your nearest Wickes representative or get in touch with our engineers here in Saginaw.

Wickes Type A Steam Generator

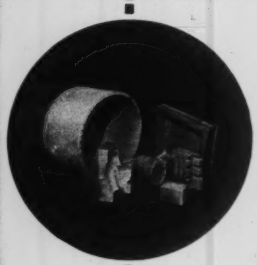


WICKES

127

THE WICKES BOILER CO.
SAGINAW, MICHIGAN
DIVISION OF THE WICKES CORPORATION

[illegible] • Houston • Indianapolis • Los Angeles • Milwaukee • [illegible] gfield • Seattle • St. Louis • Tulsa • Mexico City • Buenos



This series of advertisements is presented in the belief that there are chemical, metallurgical and other engineers who will find in some of the properties of Super Refractories by CARBORUNDUM the key to new or more effective uses of heat—and of refractories. We would like to talk over specific jobs with anyone who sees such possibilities.

Here's a refractory as rapidly as

Super Refractories by CARBORUNDUM possess a number of interesting properties not usually associated with refractory materials—properties that can be used to obtain unusual results.

Among these products are CARBOFRAX silicon carbide refractories. And one of their unusual characteristics is high heat conductivity. *At elevated temperatures, this property closely approximates that of nickel-chromium alloy steels.*

This characteristic has led to interesting applications. For example, it is not obvious that high heat conductivity is an advantage in checker brick—but it is. CARBOFRAX brick, when used in checker work, absorb—and deliver—two to five times as much heat as fireclay brick in a given period of time. You can recover more heat with fewer brick (and therefore with smaller regenerators, less pressure loss.) Or you can get higher temperatures if you want them. Even one or two rows of CARBOFRAX brick will often make a lot of difference.

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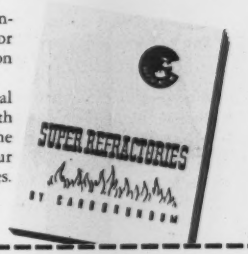

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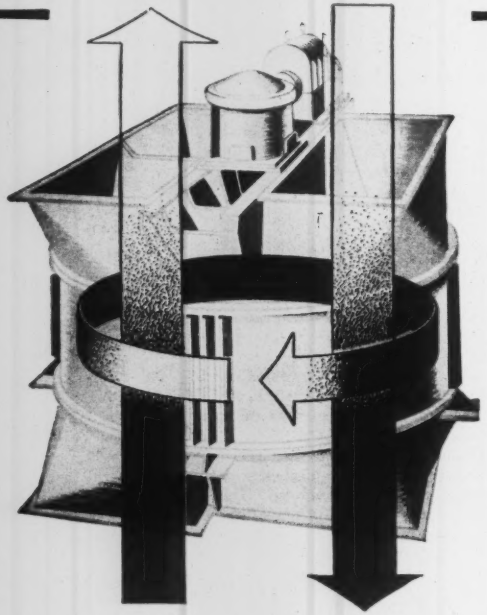

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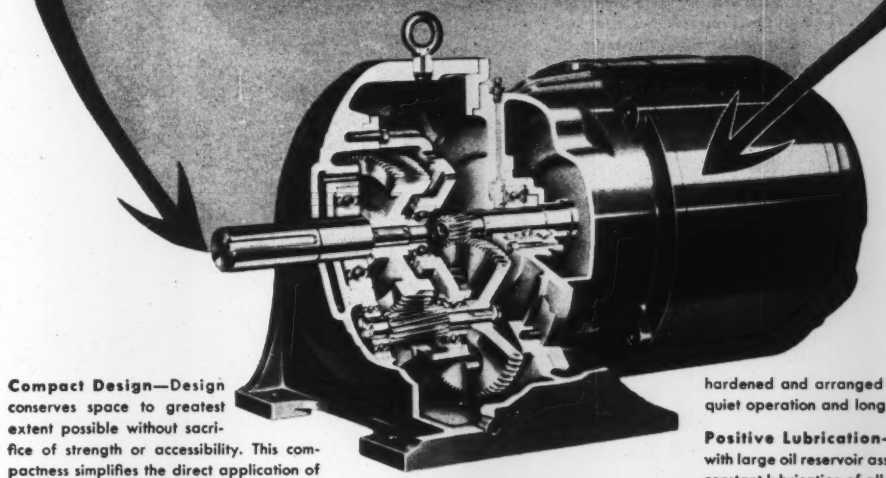

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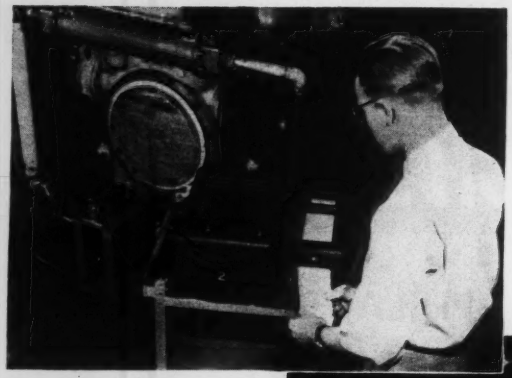

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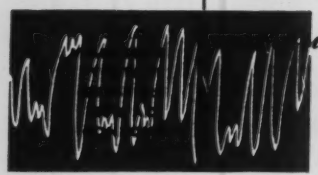

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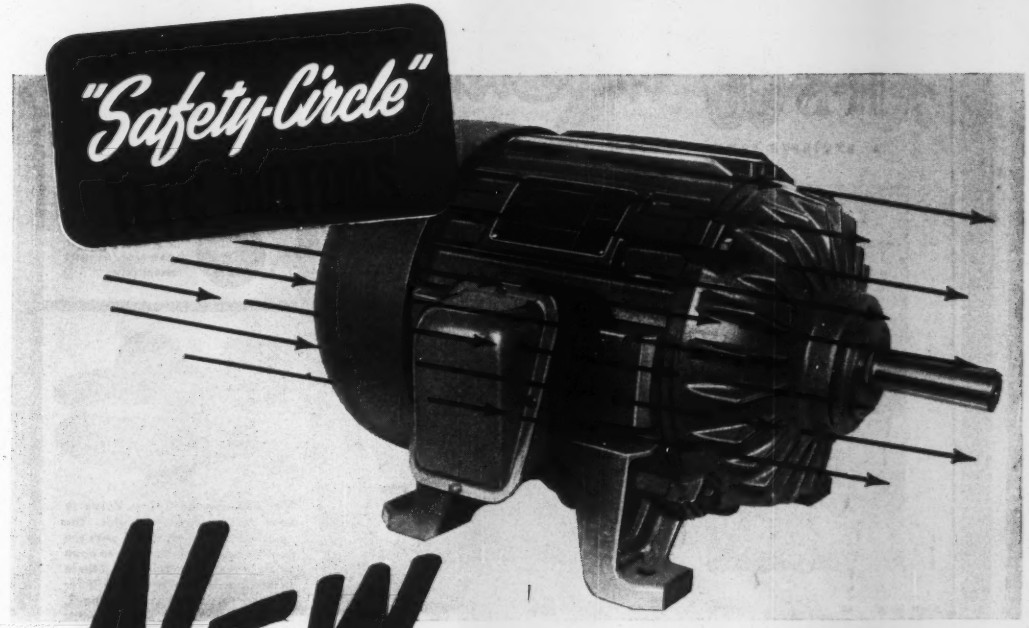

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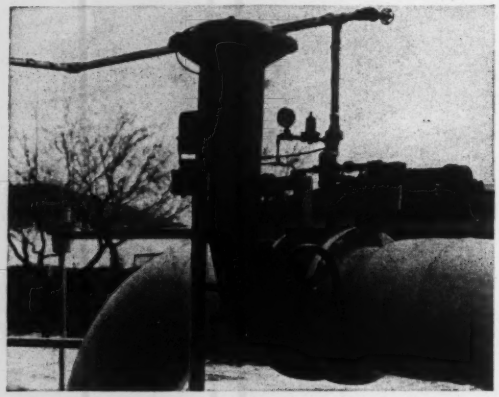

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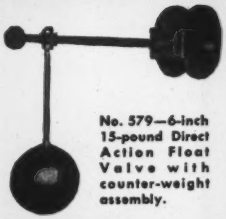

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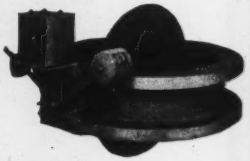

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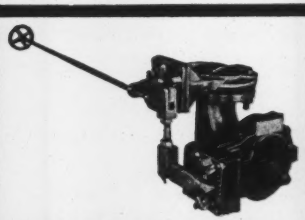

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Published by The American Society of Mechanical Engineers

VOLUME 73 NUMBER 3

Contents for March, 1951

CHANGING PATTERNS OF FUEL SUPPLY . . . . . *James Boyd* 189
THE FIELDS OF UTILITY OF INVESTMENT CASTINGS . . *R. L. Wood and D. Von Ludwig* 191
RADIATION PYROMETRY IN THE STEEL INDUSTRY . . . . . *Donald Robertson* 198
THE APPLICATION OF CUTTING FLUIDS TO MACHINING OPERATIONS . . . . . *R. B. Niebusch and E. H. Strieder* 203
A BUSINESSMAN'S RESPONSIBILITIES IN REARMAMENT . . . . . *E. L. Lindseth* 208
PLASTICS LITERATURE REFERENCES . . . . . *H. M. Richardson* 211
PLANNING YOUR FUTURE . . . . . *T. A. Marshall, Jr.* 216

EDITORIAL 187
BRIEFING THE RECORD 219
ASME TECHNICAL DIGEST 233
CONTENTS OF ASME TRANSACTIONS . . 242
COMMENTS ON PAPERS 243
REVIEWS OF BOOKS 246
ASME BOILER CODE 249
ENGINEERING PROFESSION—NEWS, NOTES 253
ASME NEWS 267
ASME JUNIOR FORUM 275
ENGINEERING SOCIETIES PERSONNEL SERVICE 276

CLASSIFIED ADVERTISEMENTS . 103
CONSULTANTS . . 110
ADVERTISERS 112

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Published monthly by The American Society of Mechanical Engineers. Publication office at 20th and Northampton Streets, Easton, Pa. Editorial and Advertising departments at the headquarters of the Society, 29 West Thirty-Ninth Street, New York 18, N. Y. Cable address, "Dynamic," New York. Price to members and affiliates one year $3.50, single copy 50 cents; to nonmembers one year $7.00, single copy 75 cents. Postage outside of the United States of America, $1.50 additional. Changes of address must be received at Society headquarters three weeks before they are to be effective on the mailing list. Please send old as well as new address. . . . By-Law: The Society shall not be responsible for statements or opinions advanced in papers or . . . printed in its publications (B13, Par. 4). . . . Entered as second-class matter at the Post Office at Easton, Pa., under the Act of March 3, 1879. . . . Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on January 17, 1921. . . . Copyrighted, 1951, by The American Society of Mechanical Engineers. Member of the Audit Bureau of Circulations. Reprints from this publication may be made on condition that full credit be given MECHANICAL ENGINEERING and the author, and that date of publication be stated.

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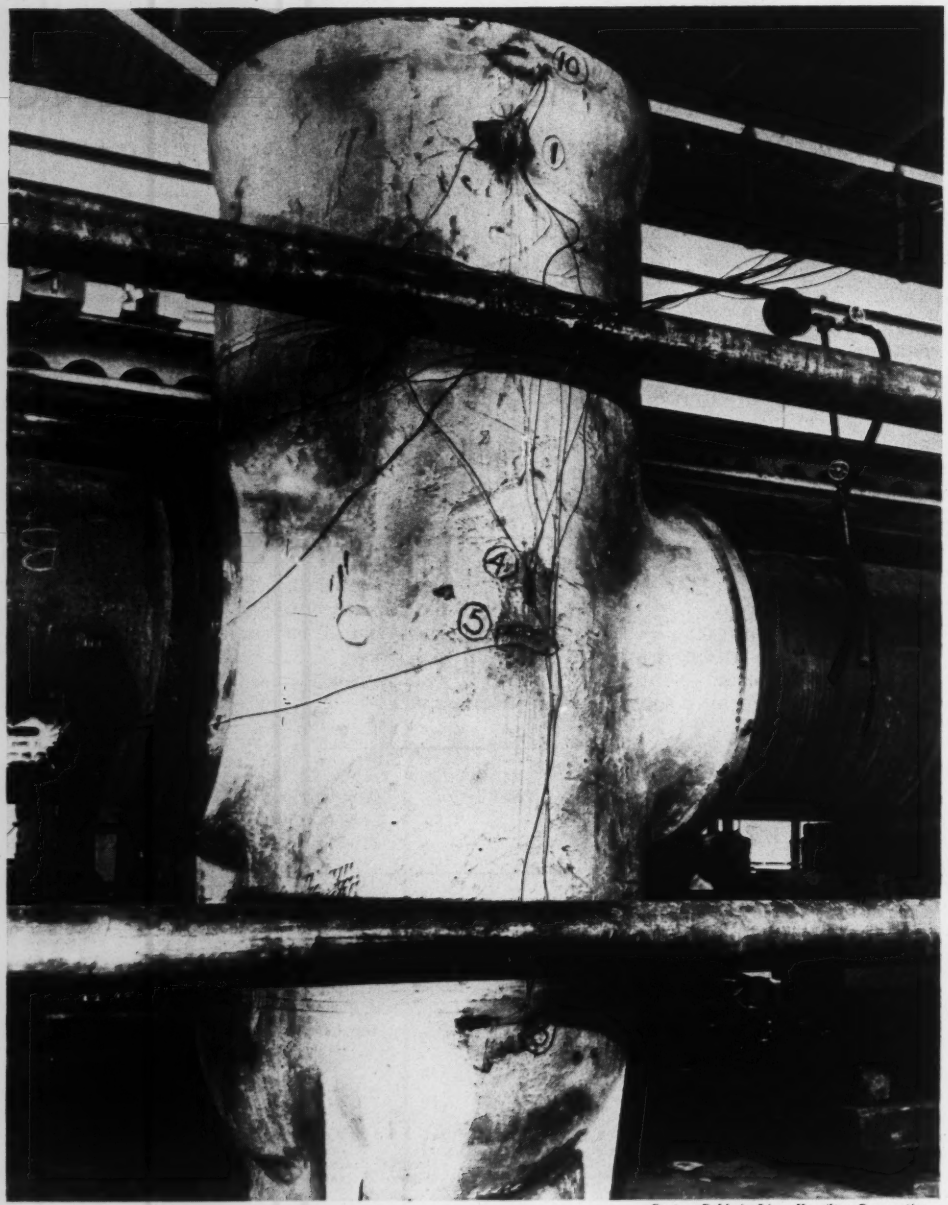

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MECHANICAL ENGINEERING

MARCH
1951

GEORGE A. STETSON, *Editor*

Unity Organization for Engineers

ENGINEERS are being given an opportunity to express their preference for the kind of organization they would like to promote the greater unity of the engineering profession.

For more than a year an exploratory group of representatives of fifteen national engineering societies, brought into being by the Engineers Joint Council, has been at work on this question of a "unity organization." On December 16, 1950, this group adopted a report of its Planning Committee in which four plans are set forth for discussion by engineers and the societies of which they are members. Each of these four plans is outlined on pages 254-255 of this issue, accompanied by simple organization charts which show the relationship of the individual engineer and the existing engineering societies and other bodies to the particular unity organization suggested. A letter signed by J. Calvin Brown, president ASME, to be found on page 266, urges every member to study the four plans and form his own opinion of the one which he personally would prefer to support.

At present the four suggested plans are in the discussion stage. The fifteen societies represented in the Exploratory Group are requested not to take formal action at this time. Full discussion and expression of opinion *is* desired by the Exploratory Group at this time. The Exploratory Group then proposes to reconvene and hopes to be able to recommend a single plan of unity organization to the constituent societies. The societies now find themselves in a critical position which demands the widest publicity to insure ample discussion of a question of great importance to the future of the engineering profession.

In the report of the Planning Committee, which the Exploratory Group adopted, certain principles are set forth which form the general basis for the establishment of a unity organization. Each of the four plans put forward for discussion has been brought within the framework of these principles. Hence in considering these plans the following summary of the principles should be helpful:

(1) The unity organization should be formed by the modification and development of a present organization or by the integration of two or more present organizations rather than by the establishment of an entirely new organization.

(2) It should initially include the participation of a majority of the national engineering societies represented in the Exploratory Group.

(3) Provision should be made for membership of individuals paying dues to the unity organization, either directly or through the participating society.

(4) Control should lie in directors appointed or elected by the participating societies.

(5) Activities should be determined by the governing body under a broad statement of general purposes. Illustrations of objectives follow:

(*a*) To advance the general welfare of mankind through the technical knowledge and creative ability of the engineering profession

(*b*) To promote co-operation among the various branches and groups of the engineering profession

(*c*) To develop sound policies respecting public affairs in which engineering is an important factor

(*d*) To stimulate engineers to take their proper place—individually and collectively—in public affairs

(*e*) To advance the standards of engineering education

(*f*) To maintain high professional standards among engineers

(*g*) To enhance the recognition of engineering as a profession

(*h*) To further the professional progress of young engineers

(*i*) To aid and encourage the advancement of the theory and practice of engineering principally through its affiliated societies.

These constitutional provisions imply certain specific purposes, such as:

(*a*) To foster the relations of the engineering profession with other professions and the sciences

(*b*) To guide the co-operative activities, within its scope, among the various national engineering societies

(*c*) To correlate the activities, within its scope, of regional, state, and local engineering and quasi-engineering organizations

(*d*) To assist in co-ordinating student chapters of engineering societies

(*e*) To assist governmental units in matters referred by these units to the engineering profession

(*f*) To express the views of the engineering profession on public questions with an engineering aspect

(*g*) To analyze and express opinion on proposed or pending legislation on which the engineering viewpoint can be of value

(*h*) To formulate criteria for colleges of engineering and to help develop the educational and vocational orientation of young men wishing to become engineers

(*i*) To study the economic status and employment of engineers

(*j*) To increase public recognition of the achievements of engineering

(*k*) To offer co-operative facilities where feasible to engineering societies (on such matters as library, office space, publishing, placement service).

(6) The unity organization should be recognized by the constituent societies as the major organization for co-operative work.

(7) It should deal directly, within its field of activity, with government agencies and others as a representative of the engineering profession.

(8) It should have its own staff.

The complete report of the Exploratory Group, which has been sent to ASME sections for study and discussion, contains a comparative analysis of the four plans for establishing a unity organization and a description of each plan. Although the essential elements of each plan have been previously stated in this magazine and may be found elsewhere in this issue, it may be useful to summarize them in the light of the foregoing principles.

Plan *A*, the EJC plan, proposes an expansion of Engineers Joint Council to include other engineering societies. Individual membership is to be accorded to individual members of the constituent societies and is thus automatic. The governing body is to be made up of 1 to 3 representatives of each of the societies composing the Exploratory Group. Individual members would have no direct representation, and would make no direct payment of dues. Expenses are met by the societies.

Plan *B*, the modified EJC plan, proposes an expansion of EJC to include other engineering societies and also provides for a voluntary individual membership. The governing board would include 1 to 3 representatives of each of the societies of the Exploratory Group and 1 to 5 elected directly by individual members. A portion of the expense would be met by the societies, 10 to 25 cents per member, but a greater part by the dues of individual members, say, $10 per year or less.

Plan *C*, the merger plan, provides for a merger of EJC and the National Society of Professional Engineers and the expansion of this merged body to enable it to represent the entire engineering profession. Society membership would be conditioned on the meeting of certain standards, and hence uniform requirements for a basic grade are recommended. Persons meeting basic membership-grade requirements would be eligible for membership. The governing body would include representatives of the constituent societies in proportion to their membership and financial support. Individual members would be represented through state societies. The size of this governing body would necessitate election by it of a small board of trustees to carry on active management of the affairs of the organization. The societies would make financial contributions. Individuals would pay dues fixed by the unity organization and collected by state societies.

Plan *D*, the NSPE plan, proposes adoption of NSPE as the unity organization and expansion of its membership and activities through the co-operation of other engineering societies. Membership would consist of state societies—not the national technical societies—and registered engineers as individuals. NSPE would change its membership requirements, at least for a period of years, to provide a form of membership for qualified nonregistered engineers. The member state societies would elect directors. NSPE should have on its board of directors representatives from other societies, which would participate in its unified activities and be selected by them. Individual members elect officers of national societies and governing boards of local sections which in turn elect governing bodies of state societies. Dues of individual members would be fixed by the national organization and collected by state societies.

In setting forth the principles for the establishment of a unity organization and in concentrating attention on four plans of organization, the Exploratory Group has laid the groundwork for intelligent comparison of those plans. This represents a distinctive service to the engineering profession which deserves the sincere thanks of every engineer. The next step is up to him and to the society of which he is a member. Which plan has your endorsement?

Significant Boiler Code Action

AN ACTION of the ASME Boiler Code Committee taken on November 3, 1950, and announced on pages 249–252 of this issue, is of considerable significance in the history of this useful and important Code. This action, in which approval was given to Case No. 1116, implemented and put into effect, for a trial period of one or two years, the General Rules for Selection of Specifications for Ferritic Plates and Tubular Products approved at previous meetings of the Committee.

In a statement signed by Perry R. Cassidy which is published with the Case, it is said that "Case 1116 will permit the use of any ASTM specification, Government, or other specification in ASTM form which covers within the limits of the General Rules and complies with their requirements, without reference to the Committee."

As Mr. Cassidy explains in his letter, this action will greatly ease the burden of the work done by the Boiler Code Committee and obviate the delays that, in the past, have resulted from the necessity of referring requests for approval of changes in the chemical or physical qualities of certain grades in SA specifications to a materials subcommittee and to the subcommittee on Stress Allowances for Ferrous Materials for assignment of design stresses. The Case will be of considerable importance to producers of steel for boilers and pressure vessels and to designers, inspectors, fabricators, and operators of such equipment, particularly in event of emergency conditions.

The Case also illustrates the close co-operation which exists between ASTM and ASME and the confidence of the Boiler Code Committee in ASTM procedure in publishing steel specifications that may be used with safety. As Mr. Cassidy points out, it also illustrates the confidence of the Committee in steel producers "in going beyond the requirements of specifications to produce better and better steel."

Changing PATTERNS *of* FUEL SUPPLY

By JAMES BOYD

DIRECTOR, U. S. BUREAU OF MINES, WASHINGTON, D. C.

THE history of the use of energy in our country is a story of shifts from one fuel to another. As our economy has grown and changed through the years, the pattern of energy consumption also has been changing. During the first eight decades of the nineteenth century, wood was our chief source of fuel and energy; but even then mineral fuels were being rapidly substituted for it.

Beginning about the middle of the last century, anthracite and then bituminous coal began to take the market away from wood. Although wood had furnished over 90 per cent of the energy during the first half of the century, it contributed only a little over 50 per cent during the second half; by the end of the century it was supplying only about one fourth of the total. This shift was due to the rise of the anthracite industry; a little later, bituminous coal came along to outrank anthracite in the amount of energy supplied. Petroleum and natural gas made a somewhat slower and later start, and did not really hit their stride until the twentieth century. The use of mineral fuels has been accompanied by a rising per capita consumption—from 100 million Btu when wood was pre-eminent to about 250 million Btu today.

RISE IN PETROLEUM CONSUMPTION

The pattern of energy consumption in the United States has changed drastically during the first half of the twentieth century. Coal provided by far the greatest portion of our total energy supply in 1920, but petroleum, natural gas, and water power have absorbed almost the entire increase in our total requirements since then. For the past 30 years or so, the growth in petroleum and natural-gas supplies has been faster than the rate of growth of total energy requirements of our economy. Hence oil and gas have tended to provide for United States fuel requirements as they expanded, while coal production has been relatively stable, except in periods of major emergency. Thus the proportion of our total fuel needs provided by coal declined from over 78 per cent in 1920 to less than 40 per cent in 1949. The share of petroleum increased in the same period from 15 per cent to almost 37, and that of natural gas from 4 per cent to over 19.

Since World War II, the trend toward use of oil and gas fuels has been accelerated by the construction of many long-distance pipe lines to bring natural gas to major consuming areas and by the utilization of depleted gas and oil fields in the eastern states as storage reservoirs for gas transported in summer months to augment supplies during peak demand periods in winter. Liquefied petroleum gases, used for heating and other household purposes in rural or remote areas, are today a major petroleum product. Rapid expansion in the use of Diesel engines for rail and highway transport, for construction work, and for farm equipment has increased the demand for the light fuel oils. There have been record installations of space-heating equipment in the postwar years, and increased quantities of heavy fuel oils have been used in generating electricity. By far the largest amount of petroleum continues to be consumed in our 44 million motor vehicles.

The elements of petroleum supply have also undergone significant changes, particularly since the early years of World War II. The production of crude petroleum in the United States has increased by over one third since the beginning of World War II, but in this period the production of liquids extracted from natural gas has almost doubled, and imports of crude petroleum and petroleum products have about tripled in volume. The relative importance of imports is therefore much greater now than at any time in the recent past.

Venezuela is our leading source of foreign petroleum, but in recent years development of vast and highly prolific production in several countries of the Middle East has brought supplies from that remote region. From a strategic point of view, the discovery and development of major reserves of petroleum in western Canada since 1947 have great importance. These new sources of supply have already made the Dominion much less dependent upon oil produced in the United States and may in time bring about Canadian self-sufficiency in oil. A major pipe line to carry this Canadian oil to a shipping point near Duluth on Lake Superior is now nearly completed. In Mexico, recent gains in exploratory activity by the Government and by sources of United States private capital suggest that the strategic supply position of North America may be further strengthened.

Total demand for oil and oil products is expected to exceed 2.4 billion barrels in 1950—a gain of about 9 per cent over 1949. Domestic demand is estimated at approximately 2 1/3 billion barrels—an increase of more than 10 per cent. The trend is even more apparent when we consider the per capita annual demand of the past 30 years—4.3 barrels in 1920, 7.6 in 1930, 10.1 in 1940, and an estimated 15.5 in 1950.

STUDY OF ENERGY SOURCES

The shift in fuel patterns has been so great as to cause concern in many quarters and to call for consideration by all who have a responsibility in this regard. Among others, the United States Senate, through the Committee on Interior and Insular Affairs, has expressed a serious interest in our energy resources. This committee of the Senate is currently investigating the problem and may make recommendations with respect to the policies that it considers desirable and necessary.

Until recently, policy considerations were based upon a study of each individual fuel industry, ignoring all the others. It has come to be realized, however, that we cannot study any one fuel industry apart from the others and get meaningful answers. The trend in technology is toward expanding the area of interfuel competition, either by introducing new devices for utilization or by increasing knowledge of converting the various fuels into forms usable in present-day equipment. An example of the developing technology of the former type is the gas-turbine locomotive burning pulverized coal. The synthetic fuels illustrate the latter. The only significant uses in which substitution is now feasible are motor fuel for motor transportation and aircraft, including gasoline, kerosene, and certain distillates, metallurgical coals for the manufacture of coke for blast furnaces, and natural gas for the manufacture of carbon black and glass. In future, if technology progresses far enough to overcome certain cost factors, and if this country is willing to bear the cost of lost energy in making the transformations, these uses may become vulnerable to substitutes, directly or indirectly. For example, if liquid fuels are derived syn-

Address delivered at the Fuels Division Luncheon, Annual Meeting, New York, N. Y., November 30, 1950, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

thetically from coal on an economic basis, coal could compete with oil as a source of automotive fuel.

If we had boundless supplies of all fuels, these facts would be unimportant. However, our reserves of petroleum are relatively limited. In recent years there have been annual additions to proved reserves, and a record number of explorations and discoveries since 1946 has improved the reserve position relative to production rates, but we can hardly assume that such successes will continue year after year, even with greatly improved exploration methods.

As the midway point of the twentieth century, this year marks the beginning of a significant decade—a decade in which authorities in both the petroleum industry and Government have indicated that domestic petroleum production probably will pass its peak and may begin to decline. Moreover, they anticipate that this decade will witness the initial development of a new basic industry engaged in producing synthetic liquid fuels, first from natural gas, then from oil shale and coal.

Eugene Ayres, Director of the Chemistry Division of the Gulf Research and Development Company, recently summarized[1] the fuel problem and indicated what we may expect in the near future, as follows:

"The synthesis of liquid and gaseous fuels is important because (1) the world, particularly the United States, is committing itself irrevocably to a liquid and gaseous-fuel economy, and (2) production of petroleum and natural gas is sure, sooner or later, to decline. We expect to need more and more but we shall finally obtain less and less. The consensus of experts in the petroleum industry, as summarized by a Congressional Committee in 1947, is that petroleum production in the United States will reach its peak between 1955 and 1960, and that by 1967, production will be no more than a billion barrels a year—about half of our present rate of consumption."

COMPARISON OF FUEL RESERVES

At this point I want to interpose a word of caution with regard to comparisons of reserves. Among our reserves of energy, only coal and water may be measured accurately enough to provide satisfactory estimates of the total available. In contrast to the underground occurrence of solid coal in layers in a succession of sedimentary rocks and to water power which can be estimated from surface data, liquid petroleum and natural gas are mobile substances that move through minute openings in the rocks and accumulate only where geologic conditions provide traps that prevent further migration. Various conditions create such traps, and it is impossible to predict either the number in the widespread, thick sequences of sedimentary rocks or the total amount of recoverable oil or gas that they contain. Until accumulations of oil or gas are discovered by drilled wells, their existence and potential production are unknown, and they cannot be classed as recoverable reserves. The quantities of oil and gas that ultimately will be available from domestic fields unquestionably will prove to be far greater than the present proved reserves.

However, barring unexpected developments in atomic or solar energy, the anticipated gap widening between domestic demand and supply will have to be met by synthetic liquid fuels and imports. It is obvious that the security of our liquid-fuels position will be greatly enhanced when the supply is based in part upon solid fuels, such as coal and oil shale, which compose more than 95 per cent of our proved fuel reserves.

The first synthetic gasoline to enter the market will come from natural gas, since a commercial plant for converting natural gas to liquid fuels already has been built. However, reserves of natural gas, like petroleum, are limited. Synthetic-fuel processes also can play an important part in meeting requirements for strategic chemicals. Current shortages and increasing requirements for benzene, phenol, toluene, and certain other chemicals could accelerate the schedule for constructing the initial coal-hydrogenation plants, since these chemicals would be produced from such plants in important quantities.

Several months ago the Bureau of Mines undertook a study to determine the effect of a synthetic-fuels plant in relieving shortages of certain chemicals, particularly benzene and phenol. These are important raw materials for the manufacture of many other essential products.

A coal-hydrogenation plant could be operated in such a manner that the yields of benzene, toluene, and xylenes would be increased by about 25 per cent, but this would result in a proportionate reduction in the yield of gasoline. Many other products are obtainable from coal, but there is no present demand for them because they have never been produced in quantity. Many of these can be recovered by minor process changes.

Shale oil likewise contains significant amounts of aromatic chemicals now in short supply. These include tar acids—phenol, cresols, and xylenols—together with tar bases, present as homologues of pyridine and quinoline. In a laboratory unit, the Bureau has demonstrated that a highly aromatic feed stock can be produced by retorting pulverized oil shale with radiant heat, a process completed in a fraction of a second. The product, a gasoline-boiling-range material with octane number near 100, may also be used as a source of aromatics. If radiant retorting can be proved commercially feasible in large-scale equipment, the yields of benzene and toluene available from oil shale by this process will be very impressive.

The patterns of fuel supply are constantly affected by technologic progress, changes in the industrial economy, competition among the fuel-supplying industries, and aggressive marketing, the supply picture, and consumer preference. The relatively rapid shift from the use of fuel gas manufactured from coal to natural gas is an example. In 1929, 1.5 million tons of bituminous coal were converted to fuel gas while 1.2 trillion cubic feet of natural gas were used; in 1947, only 0.9 million tons of coal (or 25 per cent less coal) were converted to gas, and 2.9 trillion cubic feet (or more than 250 per cent more) of natural gas were consumed.

The full facts concerning the end uses of the various fuels have never been explored thoroughly. What, for example, happens to bituminous coal after it is mined? We know that some never leaves the mine tipple but is used right at the mine; some is exported; some is made into briquettes; another portion goes to utility plants; a small quantity goes to petroleum processing; some is charged in coke ovens to make fuel gas; and the remainder eventually is consumed by transportation facilities, by various manufacturing industries, and for heating commercial establishments and homes. But how much is used in each of these categories? To what extent is one type of fuel replacing another in each class of use?

STUDY OF FUEL-CONSUMING HABITS

The Bureau of Mines has undertaken to find out just what is happening to our fuel-consuming habits. We are now preparing a statistical "run-down" for 1929, 1939, and 1947, which happen to be the years in which a census of manufactures was taken. We propose to follow this study with others, so that eventually we will have an accurate picture of the shifting pattern of fuel supply and the factors that seem to bring about these changes. Our country's industrial prowess and growth, like those of other highly developed civilizations, are based in large part upon our fortunate abundance of energy resources. It is important to know where and how our various fuels are being utilized.

[1] "The Fuel Problem," by Eugene Ayres, *Scientific American*, vol. 181, December, 1949.

The FIELDS *of* UTILITY *of* INVESTMENT CASTINGS

By R. L. WOOD and D. VON LUDWIG

ARWOOD PRECISION CASTING CORPORATION, BROOKLYN, N. Y.

OUR purpose in this paper is to present an illustrated discussion of the many types of problems which are being handled every day by the investment process. To this end we have selected a number of castings. Separated into four groups, they afford a logical way to consider the broad aspects of investment-casting applications.

CASTINGS MADE BY INVESTMENT PROCESS

Castings which cannot be produced by any other process form the first group. Consideration of the factors of alloy choice, complexity of design, or required tolerances have dictated the selection of this process in these cases. A most obvious illustration would be a turbine bucket made from high-melting alloys, which cannot be forged economically. This type of part has been amply illustrated since the first publication of information about the process. In many instances, the actual physical properties attainable in the investment mold, as compared with some alternative technique, weighs the balance.

Castings which previously were made by other processes form the second group. Many were formerly assemblies of smaller components, stampings, screw-machined parts, die castings, forgings, spun and drawn units, and the like. Simplification of design, increase in rigidity, reduction of weight, ability to choose a more suitable metal, as well as reduction of cost, all led to the choice of the investment process for these pieces. This group is currently the largest one in production.

Castings which served as trial material during design evolution form the third group. This is a relatively new field for the investment industry, one which was not particularly sought after, for obvious reasons, but one through which design and industrial engineers may attain new economies in development cost and new efficiencies in product performance. It is, therefore, a field which will become of increasing worth to the investment industry. The parts which illustrate this group were ultimately mass-produced as either forgings or die castings. The investment castings were used to run performance tests on the evolving design without incurring the excessive expense and risk of the tools and dies needed to make similar tests of the forged or die-cast part.

The fourth and last group includes castings being investment-cast but which represent an uneconomic application of the process owing to incorrect design or materials selection. Lack of information about the process may cause parts to be assigned to the investment process which are not justified in the ultimate economics of the application. Usually these parts are production headaches in the foundry and should not be cast at all, or surely not in the design attempted.

Castings Not Made by Other Processes. Four castings illustrate the first group. Fig. 1 is a manganese-bronze zipper slider for a waterproof diving-suit zipper. It can be produced only by investment casting. The close tolerance and intricacy required in the coring of the slot, coupled with choice of alloy, prevented the use of the die-casting process.

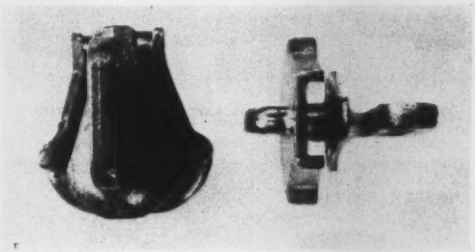

FIG. 1 MANGANESE-BRONZE ZIPPER SLIDER

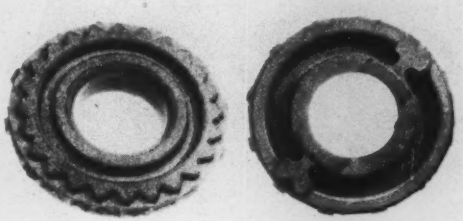

FIG. 2 PRINTING WHEEL FOR CONTROL TIME DEVICE

A printing wheel for a control time device, Fig. 2, formerly consisted of four components assembled after machining from steel. The sunken and raised engraved numbers are used as-cast. A single reaming operation, followed by hardening, are the only operations required before assembly. The total cost is considerably less than the steel assembly.

An aluminum-alloy aircraft clutch-arm casting, Fig. 3, must pass all radiographic, physical, and chemical standards, and must be wholly interchangeable to service with other castings incorporating matching radial serrations. When these parts were machined, each clutch assembly had to be hand-filed and fitted and was not interchangeable in the field. As-cast, the radial serrations are precise and identical from piece to piece. The high physical properties specified for the part prohibited the use of die castings.

Fig. 4 shows an aircraft ignition harness fitting. The design illustrated is unattainable by any process other than investment casting. All specifications for aircraft-quality manganese bronze must be met, plus complete freedom from leakage after the machining operations have been completed. Absolute economy of mass, maximum physical properties, resistance to

Contributed by the Machine Design Division and presented at the Annual Meeting, New York, N. Y., November 26-December 1, 1950, of The American Society of Mechanical Engineers.

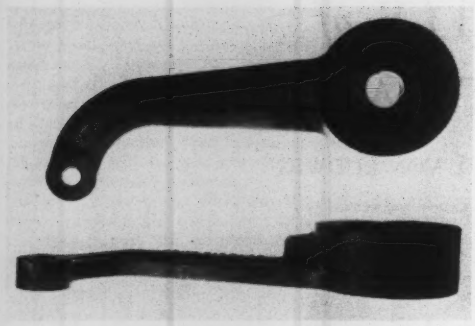

FIG. 3 ALUMINUM-ALLOY AIRCRAFT CLUTCH-ARM CASTING

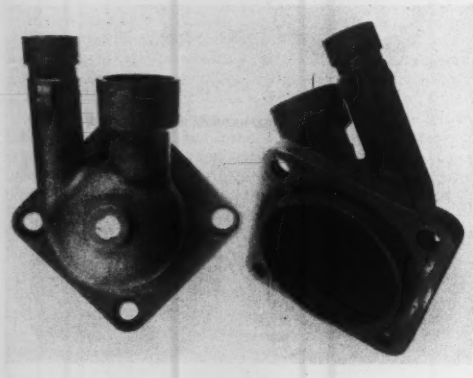

FIG. 4 AIRCRAFT IGNITION HARNESS FITTING

corrosion at elevated temperatures, and absence of porosity in the thin walls all contribute to the utility of this application. Units formerly produced by machining sand castings or forgings, or by brazing assemblies, were less strong, heavier, more subject to leaks, and four times costlier.

Castings Previously Made by Other Processes. The second grouping of investment castings includes six examples. All were formerly produced by other techniques and were essentially satisfactory in service. Changing to investment-molded parts in all cases reduced the piece price, and in most cases caused considerable modification of design. Figs. 5 through 11 are typical of the bulk of industrial castings being currently investment-cast.

The industrial sewing-machine looper casting, Fig. 5, was formerly machined from forged blanks of SAE 1020 from machining steel. In its new design, as a casting, it could be better produced in 3120 or 4130 low-alloy steel. All machining has been eliminated except grinding the shank and polishing the looper point. The point could be run to a finer radius if a freer flowing metal were used; if service permitted, a nonferrous metal could be cast to a point of 0.005 in. The cost of the finished-ground hardened casting is about 20 per cent of the former machined-forging cost.

Fig. 6 shows three views of a complex magnesium casting of Dow Metal "C" alloy. The part is a prism holder for light vest-pocket binoculars. Magnesium was originally chosen for its combination of lightness, strength, and ease of machining. The part was first hogged from solid bar at a cost exceeding $6 per unit and required several assembly operations. The finished machined casting costs less than $2.50, of which less than $2 is the casting price. The castings are completely interchangeable, whereas the machined parts varied considerably. The difficulty of machining and maintaining strength in thin walls, 0.030 in. thick, from solid bar can well be imagined.

The radar mixer body, Fig. 7, is an unusually large and complex investment casting of aluminum 356. Originally it was assembled from 22 components at a cost of $350. The final cost of the machined casting is $75 and tolerances are more closely held. The channels must be kept parallel within 0.002 in. and flat within 0.005 in. Walls must not vary in thickness more than plus or minus 0.001 in. Considerable difficulty was encountered in maintaining these tolerances in the assembled unit.

The simple bracket casting shown in Fig. 8 is typical of the usual type of work cast in alloy 356 aluminum. It was originally assembled from four components. If sufficient quantities were required to justify the tool cost, it probably could be die-cast, except for the requirement for high strength obtainable through heat-treatment of the investment casting. The design offers only one difficulty, the maintenance of parallel walls, which might warp in heat-treatment unless fixtures are provided.

The justifying cam, Fig. 9, is an exceptional illustration of complexity of design, economy of mass, and reproducibility of detail which can be attained with well-designed investment

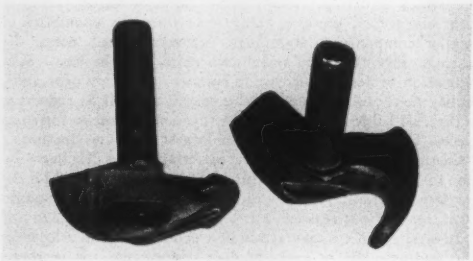

FIG. 5 INDUSTRIAL SEWING-MACHINE LOOPER CASTING

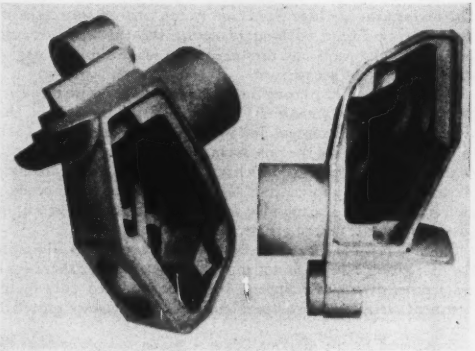

FIG. 6 PRISM HOLDER FOR BINOCULARS

castings. Originally the piece was assembled from 17 stampings and a screw-machined part. Considerable hand alignment and filing had to be done to each piece. The cost exceeded $30 each. The cast cams weigh less than one half the assembled part weight. They require no hand fitting. They wear longer, place less strain on the driving mechanism, and they cost less than one tenth the former price.

Another forging replacement, where costly finishing operations were eliminated, is shown in Fig. 10. This steel door latch can be used as cast with only a reaming cut through the hole. The slot is well designed for the process. At the base is a generous radius, the core is anchored on the sides, and no heavy sections are adjacent to create shrinkage strains. As a result, consistent parallelism of the walls can be maintained. This can be contrasted with two other illustrations, Figs. 17 and 18, where these conditions are not met and difficulty was encountered.

The postage-meter stamp, Fig. 11, was formerly machined from leaded yellow brass and then engraved. Only two finishing cuts are needed now, and the letters are used as-cast. Because leaded brass is not a good casting alloy, silicon brass is now used.

Castings Used as Trial Material During Design. The third group includes four examples. These are now being mass-produced by either die casting or forging. The investment process contributed extensively to the ease with which the final part design was determined. The cost of the soft metal die used to produce the wax patterns insured the far greater die cost of the pressure or forging equipment against design changes. Furthermore, due to the speed with which sample castings can be supplied, the production design was arrived at much more quickly than otherwise would have been possible. As the designs evolved and changes were made, suitable adjustments were made in the wax dies with little loss of time. Various alloys may be cast and tested in comparative performance tests with the same die equipment. This provides a way of fixing definitely the design of a new machine component before expensive tools are built; in addition, many times the investment castings can be used until the mass-production die tools are in use. This field of investment casting will grow quite rapidly as designers become acquainted with its value.

The motor end housing, Fig. 12, was investment-cast in 356

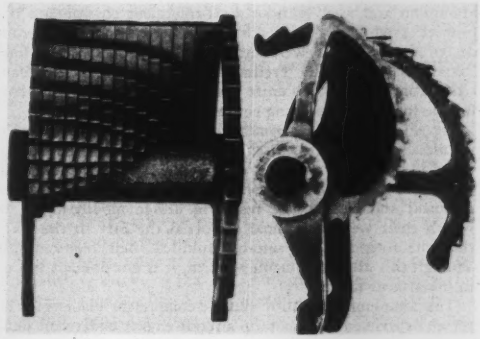

FIG. 9 JUSTIFYING CAM

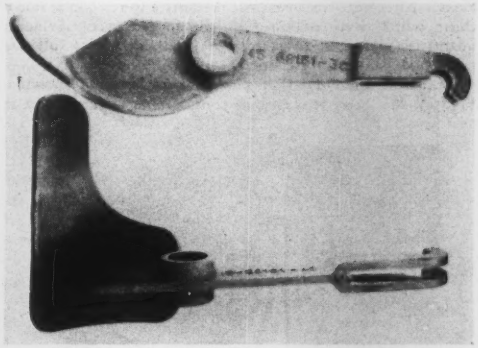

FIG. 10 STEEL DOOR LATCH

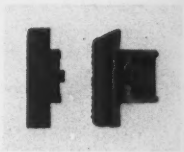

FIG. 11 POSTAGE-METER STAMP

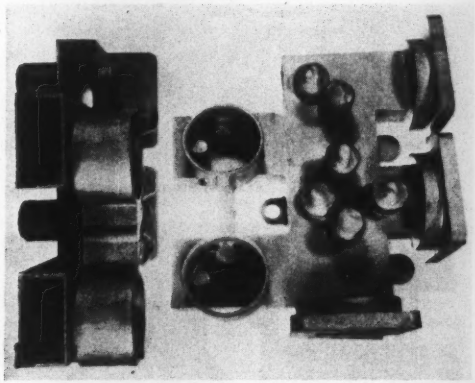

FIG. 7 RADAR MIXER BODY

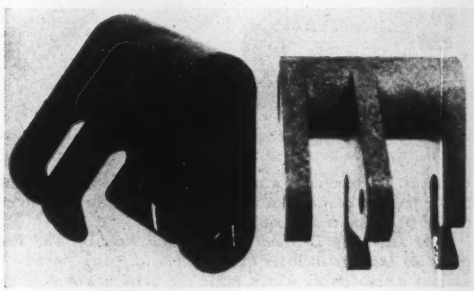

FIG. 8 BRACKET CASTING

aluminum and used without heat-treatment to simulate the properties which would result in the die casting. Numerous design modifications were made and tested before the final shape was determined. Preliminary tests may be run on quantities from 10 to 10,000 units with no additional tooling cost for the investment-molding equipment.

Fig. 13 shows an experimental aircraft forging of type 309 stainless steel (25 per cent chrome, 12 per cent nickel). Produced in lots of 10, these castings were examined radiographically, and had to comply with the most rigid physical and chemical standards. The resulting design modifications, of which there were four, finally evolved the part to the stage that the forged pieces suitably fulfilled their required job. Though this alloy is difficult to form, it is not difficult to cast in investment molds.

The aluminum 356 alloy turbine-compressor blade, Fig. 14, for an experimental turboprop aircraft engine underwent numerous changes of design before the shape of the production piece, which was made by forging, was ascertained. Here again the castings were made to the closest control specifications. After heat-treatment the properties were comparable to those which were obtained in the forged part. Sufficient quantities were cast to permit the manufacture of full-scale pilot model engines for endurance tests.

The small aluminum 356 alloy bracket bushing, shown in Fig. 15, has been produced in considerable quantities in investment. It represents a marginal case where the high cost of the pressure dies cannot be justified unless quantities in excess of 50,000 units are required.

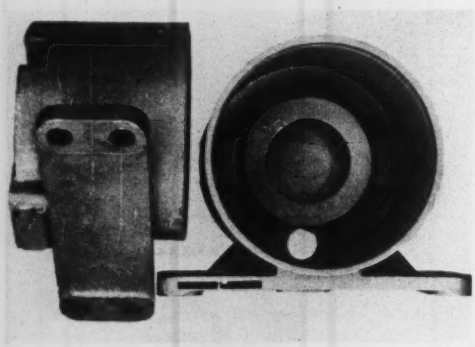

FIG. 12 MOTOR END HOUSING

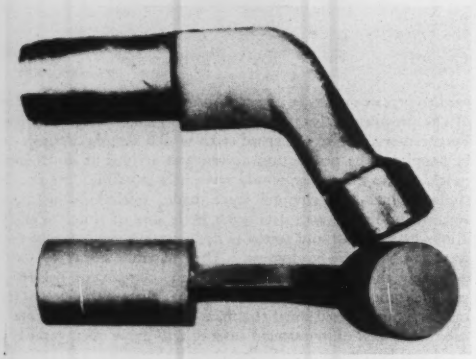

FIG. 13 CASTING OF EXPERIMENTAL AIRCRAFT FORGING

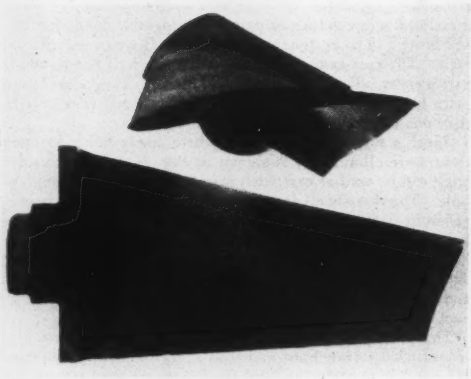

FIG. 14 TURBINE COMPRESSOR BLADE

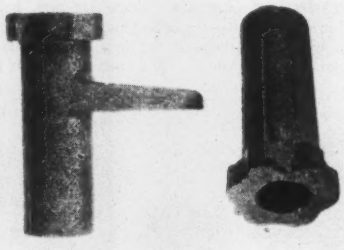

FIG. 15 BRACKET BUSHING

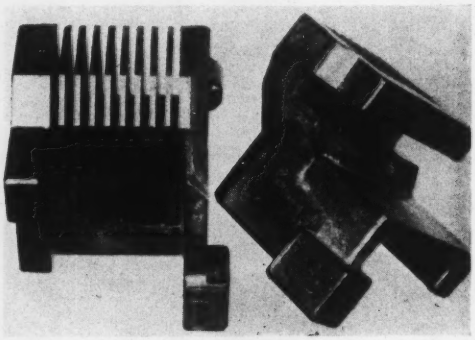

FIG. 16 PAPER TAPE GUIDE

Parts Incorrectly Designed for Investment Process. The final group of castings includes five examples of parts embodying various design errors which made the parts unsuited to the investment process. Redesign of these parts could minimize the foundry problems, in most cases, producing a better casting

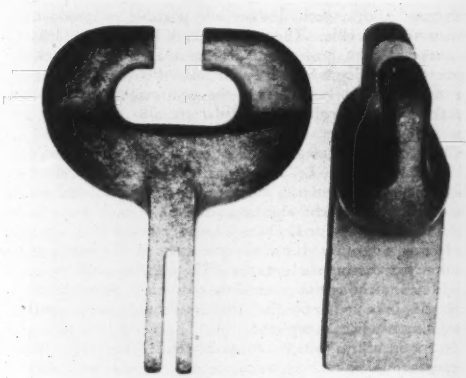

FIG. 17 CONVEYER-LINK CASTING

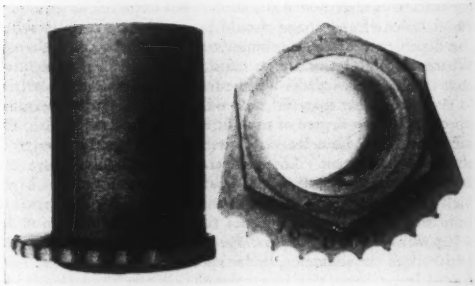

FIG. 18 AIRCRAFT WING-TIP TANK RELEASE BUSHING

at less cost. All are currently being cast in their exhibited design, but the cost is high and controls are complicated.

The aluminum-alloy paper tape guide, shown in Fig. 16, incorporates several design features best avoided. The numerous deep narrow slots must be held closely parallel and square to the abutting casting section. It happens in this particular casting that the slots do not cause the most difficulty, but the heavy walls and irregular sections in the balance of the casting do tend to twist and get out of shape owing to poor metal distribution. Lack of radii in the roots of the slots and in the angles of the casting body enhances the warping. Each part must be straightened individually and gaged in the foundry.

The conveyer-link casting, Fig. 17, cast in SAE 4140 steel is a poor design for casting purposes. The deep thin slot and the wide thin projections which form it are too directly attached to an unnecessarily heavy body section. The ratio of length, width, and thickness of metal in each finger is very bad, from the foundry point of view. Production of the wax patterns is complicated by the tendency for the waxes to warp. Costly secondary operations are needed to hold close tolerances on such a piece. Each slot must be hand-filed and cleaned before insertion of a go/no-go test bar.

Long sections of uniform thickness are hard to cast, by any process, without encountering some shrinkage. The aircraft wing-tip tank release bushing, Fig. 18, cast in SAE 4130 steel must be completely free of porosity. The uniform thickness of the cylindrical section walls presents a difficult foundry problem. The parts must pass all aircraft quality controls, including 100 per cent x ray. The compensation for shrinkage throughout the wall sections is a most difficult production headache. If this part were intended for other than aircraft applications, the yield would be much greater as internal microporosity would not be objectionable.

Extreme concentrations of mass, as shown in Fig. 19, are entirely unsuited for investment forming. The Navy bronze, 88-8 and 4 alloy, counterweight casting is used in a sequence timer in an aircraft, and therefore must pass all control specifications. Twice as much metal is required in the riser of the casting as in the body of the piece, in order to produce radiographically sound parts.

Silicon brass cannot solve problems induced by poor design, such as shown in Fig. 20. This instrument-frame casting was originally machined from a sand casting. Apparently a semifinished machine drawing was used as the casting drawing for investment forming. No provision for radii was made in the investment casting, in spite of the heavy walls projecting

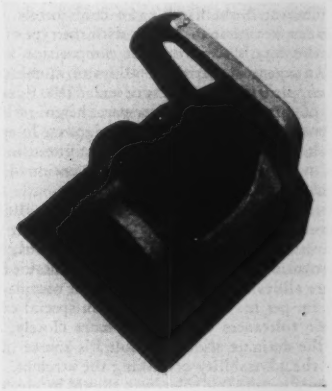

FIG. 19 COUNTERWEIGHT CASTING

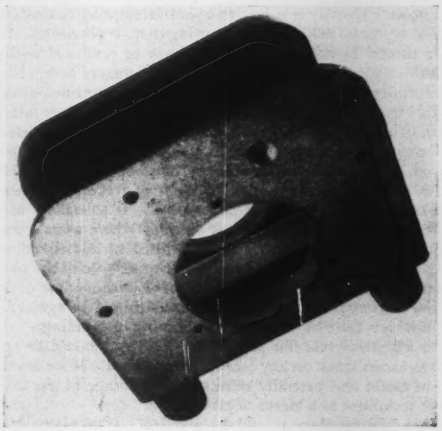

FIG. 20 INSTRUMENT-FRAME CASTING

at right angles from the base. Such U-sections cannot be cast, maintaining parallelism in the walls, without the use of tie bars at the top or along the sides. This part must be supplied with specified tolerances 0.015 in. total deviation from parallelism, and with all matching holes within 0.010 in. of alignment. The investment casting is still cheaper than former parts, but the price could be reduced, and the performance improved if the entire project was reconsidered in view of the process now being used.

BASIC FACTORS TO CONSIDER FOR INVESTMENT CASTINGS

In the course of eight years of experience in industrial production of investment castings of most ferrous and nonferrous alloys, many design practices unsuited to the process have been encountered. It is impossible to detail these in a single paper, but in an effort to assist designers in avoiding the most obvious types of mistakes, the following suggestions are offered:

It is necessary to realize that the "precision" casting process is a liquid metal-forming operation. It is subject to all of the variables inherent in the handling of fluid metals. The accuracy which can be anticipated varies with the type of alloy to be used, and the details of investment composition and foundry process. As a general rule those alloys of aluminum, magnesium, and copper which are cast at or under 2200 F can be held to tolerances of ±0.002 in. per in. or part thereof of linear measurement, providing the part is well designed. In special cases it is possible to hold one or two particular dimensions to closer tolerances when the special foundry attention demanded is justified economically.

All ferrous and high-temperature nonferrous alloys must be cast to more liberal tolerances. This is primarily due to the type of investment materials which must be used, and the inability to obtain as smooth surfaces as are obtained with low-temperature alloys. A safe design limit for routine production is ±0.005 in. per in. or part thereof. In special cases, one or two specific tolerances can be held more closely, but before doing so the designer should consult his source of supply to determine the advisability of making the attempt. In general the maximum permissible tolerances should be given for all but actual close working surfaces. When parts are correctly designed grinding operations should suffice to finish all working surfaces, aside from the necessity for drilling, tapping, or reaming holes. Usually it is best to avoid attempting to cast small holes, unless no other way of securing them is possible.

It should be noted that castings may be produced with dimensions varying within the range of tolerances herein listed. Uniformity of dimension cannot always be attained after an initial trial period, as might be expected by engineers familiar with other processes where fewer variables are encountered.

Designers frequently forget that some way of admitting the liquid metal to the casting cavity must be provided. These gates often serve the double function of feeders or risers to overcome solidification shrinkage voids. If tolerances of less than ±0.010 in. are required at sections where gates must be ground off, special fixtures must be used at additional cost. Therefore it is desirable to have the designer specify the part or parts of the casting which may be gated without loss of functional efficiency. Where possible, gates should be against surfaces which must be finished by machining or grinding.

As a general rule not more than 0.015 in. should be specified as excess stock on any face to be machined. More is wasteful of metal and partially offsets the advantage of the investment technique as a means of production.

Thin narrow slots should be avoided. It is virtually impossible to produce slotted pocket sections open on only one side in high-temperature casting alloys. In low-temperature nonferrous alloys, such designs are possible of production, though not desirable. The proportion of length to width and thickness of each projection forming a slot, determines the degree of difficulty which may be encountered in production. The mass of metal to which the projections are attached and the proportion of blending radii are also controlling factors.

Another problem of geometrical relationship is encountered in "U," "H," "T," "L," and such shapes of unbalanced nature wherein precise angularity must be attained. Liberal use of contoured fillets in the abutting sections of such parts, combined with the use of tie bars whenever possible to equalize solidification stresses, can overcome most of the problems encountered in casting such shapes. The foundry often is forced to add ties, although they are removed before shipment of the castings. It is preferable that the ties should remain until all processing has been completed.

Except in alloys which cannot be drilled and tapped, cast threads should not be specified, because at best poor fits can be attained, and then only with a chasing operation. Cast threads are seldom justifiable in an alloy which can be drilled; external threads should not even be specified in a hard metal, if the section can be reached and the threads imparted by grinding. Blind holes of any shape should be avoided, especially when the depth exceeds the minimum cross section by more than 3. Where through-holes are specified, it must be borne in mind that the interior surfaces will be rough, from the irregularities in the investment material, and will require at least a reaming operation if any degree of snug fit is to be expected. Also, the minimum hole diameter varies with the temperature range of the alloy being cast. Low-temperature nonferrous alloys can contain holes as small as 0.010 in. The minimum for high-melting metals is usually 0.015 in. In all cases the depth of hole should not exceed 5 times the diameter for holes under 0.125 in. From 0.125 in. to 0.250 in. the depth may be as much as 10 times the diameter, under special conditions where reinforced insert cores may be employed. Where the holes can be used as-cast or with a reaming cut, they are an economy in production, particularly when numerous small-diameter holes are required which would necessitate involved jigging and drilling operations.

Minimum wall thicknesses are also governed by the temperature of the metal being cast, as well as other design factors. For limited areas in low-temperature alloys, walls can be held to 0.025 in. within a few thousandths. In high-temperature metals, walls less than 0.040 in. are usually impractical for any other than very short distances. This is also true of projections from the casting body. But where a uniform taper is part of the casting design, as in turbine blades, edges as thin as 0.010 in. with final radii as slight as 0.005 in. may be produced reliably in all metals.

The flatness of a cast surface will vary inversely with its section thickness, because of the cavitation at the center caused by metal shrinkage. While this can be overcome by heavy gates and risers to each such section, the added foundry costs involved in the attachment, removal, and remelting of such attachments are considerable. It is usually cheaper to grind off enough metal to obtain a flat surface, wherever this is essential to the operation of the casting.

SOME RULES TO CONSIDER WHEN CHOOSING ALLOYS

The investment-casting process is unique in being able to produce commercially valuable shapes from any metal which can be liquefied commercially and cast. In the broad sense, the design engineer is freed from the necessity of compromising his performance and optimum shape for reasons of inability to secure the proper type of metal from the investment mold.

However, this freedom of alloy choice should be tempered by considerations of the actual performance characteristics of the cast form of various families of alloys, in particular taking into consideration foundry characteristics as they affect ease of production and uniformity of the end product. In many cases the cheapest metal, which may be quite adequate to perform ths intended job, may not produce the cheapest casting, due to ite response to the techniques of melting and casting practices by the investment foundry. Inasmuch as the raw metal used for an investment casting may represent less than 1 per cent of the final value of the finished casting, whereas the foundry processing may represent more than 80 per cent of the final price, it is economic to consider base metals of higher initial cost when their castability is better than the lower-cost material. The inverse of this may also be true, where a less costly alloy may perform quite adequately for a specified job. The specifications should stress performance requirements rather than precise chemical composition.

Elimination of most machining operations permits the designer to consider product durability as the prime design determinant. To think successfully in terms of the investment casting of alloys, only the performance required of the casting should be specified. Any competent investment foundry can provide the actual data of various types of materials which will accomplish successfully the designer's aims.

The attainment of maximum economy in procurement and utilization of investment castings will be aided by the specification of performance rather than chemical standards. While it is true that almost any alloy can be investment-cast, the arbitrary specification of alloys which differ not at all in application and only slightly in basic chemistry from those which are in large-scale production will make the castings more costly because of the more complicated foundry control.

To insist on an alloy not suited to the investment method for reasons predicated on book rules of mill standards penalizes both the foundry and the casting consumer. Try to select an alloy from the list recommended by the foundry.

Most investment castings in production today weigh less than one pound, because their precision, relative to parts produced by other processes, is reduced as their size increases. If an allowance of one half of one per cent must be made because of variations in wax, ceramic, and metal, the dimensional range on a 1-in. piece is 0.005 in. This is accurate enough to offer an advantage over all other foundry techniques, except die casting. But the same allowance will produce a variation of 0.050 in. on a 10-in. casting. In special cases this allowance can be reduced. A jet diaphragm nozzle which incorporates fifteen airfoil vanes in heavy inner and outer mounting and shroud rings, weighing over 20 lb and with a maximum diameter of 13.4 in. is being held to within 0.010 in. by one foundry. Such results are only possible with optimum design and alloy conditions.

In the lower-temperature casting alloys a part of simple design within the tolerances common both to pressure die casting and investment casting can generally be most economically produced by die casting when quantities exceed 25,000 to 50,000 units. But where the design necessitates complicated cores, it is far simpler to build and operate investment-pattern dies operating at room temperature than pressure dies operating at 800–1000 F. Complex parts of involved internal structure, almost independent of quantity, can usually be most economically cast in investment molds when within the proper range of size and metal volume.

There is no other process which combines so well the factors of dimensional control, reproducibility of design detail, and reliability of structure in small, complex metal objects. In the field of unmachinable alloys, the investment process alone is capable of producing detailed parts to any reasonable degree of dimensional accuracy.

As an aid in experimental design and development work, the investment process provides a unique method to make rapid changes in alloy, shape, and processing. By using temporary dies at low cost, enough parts can be produced for the development stage. The tested design can then justify high investment in final production tools, whether for forging or die casting. The product itself is also insured against unexpected design flaws, because the investment castings closely duplicate the physical properties which will be expected of the production parts. In a matter of a few weeks, investment castings of a new design can be provided for test purposes. Design modification can then be incorporated and tested. In every sense of the word, the use of the investment process as a trial and development tool is economically justified.

The investment process is by no means a cure-all for design problems. Until designers acquaint themselves with the potentials of the art, it is not possible to tell them, nor can they ascertain definitely, the degree of benefit they may attain from it. At one and the same time the "lost-wax" casting process is the newest and one of the oldest methods of precision liquid-metal forming; no one can yet estimate the ultimate utility which will result from it. For years to come each design engineering group will have to decide how, if at all, their products can benefit through the use of investment castings.

Members of most industries have made effective use of precision investment castings either in their products or the tools used to make their products. Many production bottlenecks have been eliminated by resorting to the investment process. Many still exist to which organizations have accustomed themselves for lack of adequate means of solving them. The investment-casting process is a new tool which can be effective in overcoming design difficulties when handled intelligently by informed engineers.

Steel Castings

STEEL castings can be made radiographically sound without recourse to padding or chills providing the distance from the perimeter of the riser to the edge of the plate is four and one half times the casting thickness. This information, based on studies of steels having 0.20 to 0.35 per cent carbon, and cast as plates with a width-to-thickness ratio of at least 3 to 1, is from a U. S. Department of Commerce OTS report.

Prepared by the Naval Research Laboratory, the report is part of a continuing study of the basic foundry methods. In the current study the relationships between thermal gradients and casting soundness were investigated through temperature measurements.

It was determined, according to the report, that three thermal zones develop during the solidification of plate castings: one adjacent to the riser, one at the casting edges, and an intermediate zone between the two, the latter essentially without a temperature gradient. Sound castings result when the intermediate zone is eliminated or at least reduced to a width of less than the casting thickness during the solidifving process.

The use of risers having diameters of three times the casting thickness was found satisfactory. In addition, it appeared that extra-large risers do not have a measurable effect on the distance that can be made sound.

Report PB 101 392, "The Contribution of Riser and Chill-Edge Effects to the Soundness of Cast Steel Plates," 21 pages, including graphs, can be purchased from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., at 75 cents per copy.

RADIATION PYROMETRY *in the* STEEL INDUSTRY

By DONALD ROBERTSON

LEEDS & NORTHRUP COMPANY, PHILADELPHIA, PA.

THE science of total radiation pyrometry is based on the Stefan-Boltzmann law, which states that the radiant energy emitted from a black body is proportionate to the fourth power of the absolute temperature of that body. A black body is one which will reflect none of the radiant energy falling upon it, but will absorb all of it and emit the maximum amount of energy possible per unit time and area at a given temperature. Such a perfect black body is said to have an emissivity coefficient of 1.00, while a perfect reflector would have an emissivity coefficient of 0.00. Fortunately, ferrous metals, especially with an oxide coating, have a fairly high emissivity, which is relatively constant over a wide range of temperature.

Hence if we know the emissivity of the surface of the body from which the radiant energy is coming, and have a detector which can translate this energy into some easily measurable form, we can determine the temperature of the body.

This type of pyrometry is quite practical for measuring the temperature of moving objects, of surfaces, in furnaces where contaminating atmospheres cause thermocouple drift, and for measuring extremely high temperatures. It is especially useful in this last case because the radiation-sensitive element does not normally reach the actual temperature of the surface being measured, but only some proportion of it.

There are other advantages to this type of pyrometry. If the radiation detector is properly designed, it can be small, accurate, and rugged, able to give readings under conditions of pronounced vibration. Furthermore, if the sensitive element is made extremely small, it will give readings in an unusually short time.

MODERN RADIATION PYROMETER

In the modern radiation pyrometer fine-gage thermocouples are connected in series to form a thermopile. The measuring junctions of the thermopile are located in a small area, and the radiation from the hot body is concentrated on them by means of an optical system. The reference junctions are near the measuring junctions, but are out of the path of the concentrated radiant energy. The optical system and sensitive element are usually sealed against drafts and contaminating gases.

Fig. 1 shows the general construction of the mirror-type fixed-focus pyrometer. The sensitive element containing the measuring junctions is at C, the mirror is at B, and the distance between them is adjusted to form an image of the front diaphragm A on the measuring junctions. Since the front diaphragm is the target, radiation between the lines G and E reaches the thermopile. The target whose temperature is being measured must extend the entire distance between these lines, as shown at F. Since the diameter of A and the distance N are constants of the instrument given by the manufacturer, the diameter of F can be figured with the equation shown in the illustration. This was one of the first types of pyrometers made, but it is still used in industry.

Fig. 2 shows a lens-type instrument, which substitutes a lens for the mirror and adds a diaphragm on the lens side of the thermopile directly in front of the measuring junction. The lens focuses the field on the diaphragm, which means that theoretically the instrument should be refocused with any change in source distance. In practice, however, it is usually designed to require no change in focus for distances of 24 to 30 in. and greater. The limiting diaphragm and measuring-junction target are visible through a sighting window, and, if these are covered by the radiation, proper readings will be obtained. One advantage of this type of instrument is that the target can be smaller than that of the mirror type. However, the target image is not extremely sharp due to spherical and chromatic aberration of the lens.

A third type of radiation pyrometer, relatively new to the industry, is the double-mirror instrument, shown in Fig. 3. The primary mirror 1 focuses a sharp image of the target on the limiting diaphragm 2. The secondary mirror 3 in turn focuses the part of the image which comes through the hole in the diaphragm onto the thermopile hot junction 4, while 5 is a front protecting window. When the instrument is directed toward a hot body, a sight through the viewing lens 6 shows the image of a large portion of the body focused on the diaphragm. But only the portion of the image which passes through the hole in the center of the diaphragm finally reaches the thermopile and causes the reading. Thus it can be determined easily if the instrument is properly aligned with the target, and if the hot body is large enough.

This radiation pyrometer requires approximately the same field size as the lens type and has some advantages, i.e., the mirror type is free from chromatic aberration and the focus is constant for all temperatures. Also, it has less spherical aberration than the lens type, and therefore defines the target more sharply. This is important when the available target size is near the theoretical target size required by the instrument.

Other advantages of this new double-mirror type are functions of design rather than of basic principles. It is hermetically sealed, well compensated for sustained and transient ambient-temperature variations, and its housing can be held at a temperature as high as 350 F without damage.

Thus far we have mentioned only the radiation-pyrometer detectors. To complete the temperature measurement an instrument is needed to measure, indicate, and possibly record the output of the detector. Since the radiation pyrometer produces electric voltage, the familiar potentiometer is again put into use. The instrument generally used is similar to the usual thermocouple recorder except that it has no reference-junction compensation, and does include a compensator for emissivity differences.

STEEL-PLANT PYROMETRY

The locations in a steel plant where radiation pyrometry is used are impressive in number.

Based on a paper contributed by the Industrial Instruments and Regulators Division and presented at the IIRD-ISA Conference, Buffalo, N. Y., September 18-22, 1950, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

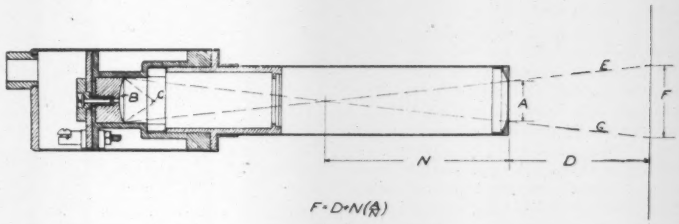

FIG. 1 CROSS-SECTIONAL VIEW OF MIRROR-TYPE FIXED-FOCUS RADIATION PYROMETER

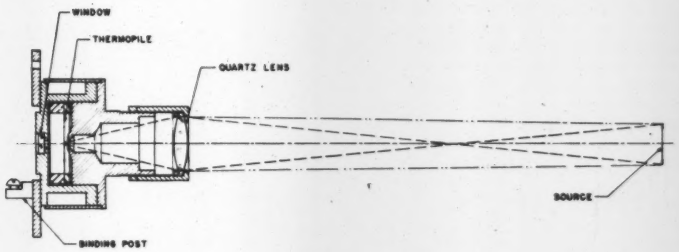

FIG. 2 CROSS-SECTIONAL VIEW OF LENS-TYPE RADIATION PYROMETER

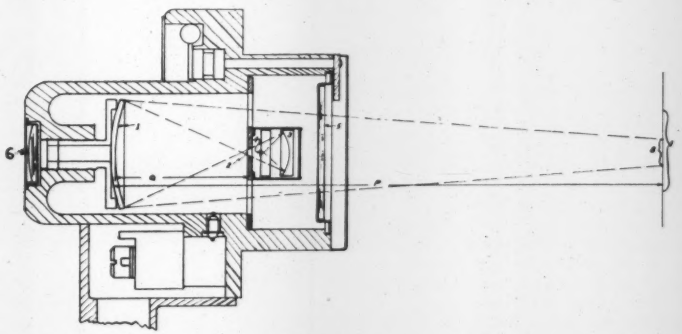

FIG. 3 CROSS-SECTIONAL VIEW OF DOUBLE-MIRROR-TYPE RADIATION PYROMETER

FIG. 4 RADIATION-DETECTING EQUIPMENT FOR OBTAINING BLAST-FURNACE-STOVE DOME TEMPERATURES
(Cover and radiation pyrometer removed.)

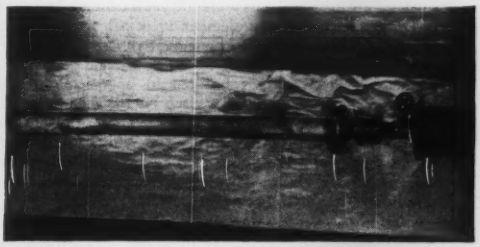

FIG. 5 RADIATION-DETECTING EQUIPMENT FOR OBTAINING BLAST-FURNACE-STOVE DOME TEMPERATURES
(Assembled unit.)

Measurement of the temperature of blast-furnace stoves is of great importance in blast-furnace operation. While it is desirable to know the air or gas temperatures at the top of the stove, it is more vital to know the actual temperature of the refractory. This measurement can be obtained by radiation pyrometers sighting directly upon the checker brick surface.

Fig. 4 shows the type of assembly used for this purpose. The nickel-chrome-alloy tube, open at both ends, bolts to the manhole cover on top of the stove, and extends into the stove. The radiation-pyrometer assembly is mounted on the flange, and between the detector and the flange is a gate-type valve which is closed when the radiation unit is to be inspected or removed for cleaning. The radiation unit is attached to the valve by a hose-type clamp which will withstand the 20-psi pressure that occurs at times during the operating cycle. Clean air at still greater pressure is introduced through a small pipe elbow mounted in the flange to keep the sighting path clear by purging the tube of dirty gases or blast air. Fig. 5 shows the unit completely assembled.

In the case of the open-hearth furnace, the temperature of the bath prior to tapping is very important. If the steel is too hot, sticking molds may occur; if it is too cold, there will be waste caused by sculls in the ladle. Furthermore, the pouring temperature has considerable effect on the metallurgical quality of the steel. It is, therefore, highly desirable to measure the steel temperature before it leaves the furnace. This can be done readily by an immersion pyrometer, a special type of radiation instrument designed for molten-steel service.

This instrument consists of a long steel tube with an air connection at one end and an open diaphragm at the other. Inside the tube, as shown in Fig. 6, is a rugged radiation pyrometer and optical system completely sealed against dirt and protected from heat by a radiation shield and by the air blowing down the tube.

The pipe is inserted into the furnace, and the orifice end immersed in the steel below the slag. Sufficient air must flow down the tube to keep the orifice open and void of steel. The detector can then sight through the orifice and onto a cavity in the molten steel as shown in Fig. 7. Since this cavity is essentially a black body, the temperature of the surface upon which the pyrometer sights can be determined.

Such an instrument must combine accuracy approaching that of the laboratory with the ability to withstand mechanical abuse. It must be ruggedly designed, and built so that frequent checks of its calibration can be made with a minimum of effort, and preferably right in the open-hearth shop. For this purpose the output of this instrument can be varied by a checking dial so that the user can make quick adjustment for calibration changes caused by dirt on the optical surfaces without disassembly and cleaning the parts.

For this adjustment there is a second radiation unit with an optical system and sensitive element identical with the one used in the steel bath. This unit is mounted on the immersion pyrometer so that the two fields of vision coincide, and both thermopiles are electrically connected in opposition to the temperature recorder. A special switch on the recorder sends the pen to a null point somewhere near the center of the scale and energizes a signal-light circuit. The whole assembly is then directed toward a hot body, such as the back wall of the open-hearth furnace, and the check dial is adjusted until a balance is indicated by the signal lights.

When making a steel reading, the operator turns on the air, inserts the open end of the instrument in the metal in the furnace, presses the button for a few seconds, then removes the unit, scrapes off the slag, and leaves it to cool for the next reading. The whole operation requires no more than a minute, and the instrument is in the furnace less than 15 sec. The

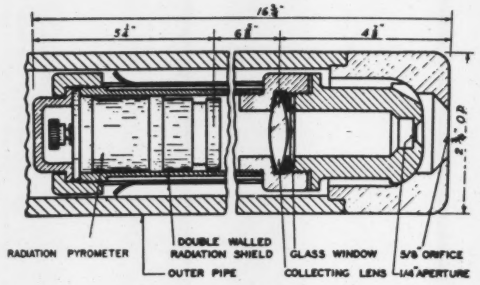

FIG. 6 SECTIONAL VIEW OF IMMERSION PYROMETER SHOWING RAYOTUBE ELEMENT IN RELATION TO INNER AND OUTER ORIFICES, RADIATION SHIELDS, AND PATHS OF AIR FLOW

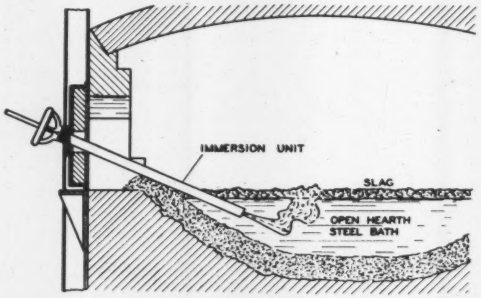

FIG. 7 SCHEMATIC DIAGRAM OF IMMERSION PYROMETER IN FURNACE

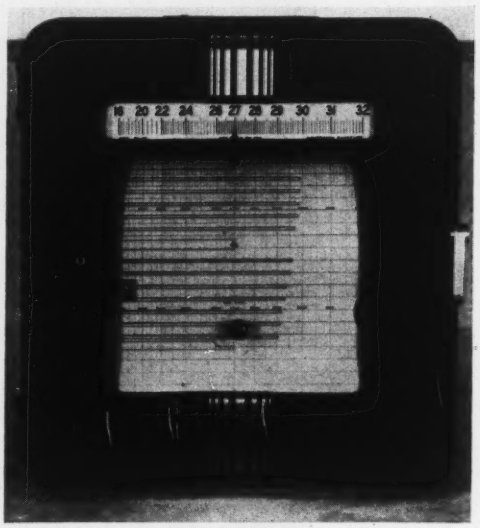

FIG. 8 RECORDING INSTRUMENT USED WITH IMMERSION PYROMETER

pyrometer can be used over and over in this manner without maintenance, and can make a number of readings without even the simple calibration check. The operator can determine by experience just how frequently checks should be made to insure accuracy.

Fig. 8 shows the recorder used with the immersion pyrometer, with a typical chart record made in the open-hearth bath. Near the center and at the top of the chart are records made when checking was performed. The switch that sends the pen to the check point is on the top of the recorder.

MEASURING TEMPERATURES IN ELECTRIC FURNACES

Another important use of the immersion-type radiation pyrometer is in electric furnaces. The more exacting metallurgical specifications of the high-grade steels made in these furnaces—stainless, tool steels, and so forth—make knowledge of the temperature during manufacture even more important than in the case of open-hearth steel. With some slight modifications the immersion pyrometer can be used to measure the bath temperature in electric furnaces.

When reducing slag is on the surface of the bath, as is the case in a number of alloys, it will eliminate the oxide protection on the surface of the outer tube, hence some of the metal bath will weld to the tube when it is immersed. A practical protection for the immersion tube is an ordinary cardboard mailing tube. It has been found that such a tube will last long enough for complete protection during one immersion. To protect the orifice end of the immersion tube not covered by the cardboard, a replaceable tip is screwed in place before the sleeve is mounted. When the instrument is removed from the bath, and the inexpensive paper tube is stripped off and discarded, it will be found that the metal tube is still cool enough to be touched with the bare hand.

Another important temperature for the open-hearth operator to know and control is that of the open-hearth roof. These roofs are expensive, but it is advisable that they be operated as near the safe temperature limit as possible to hold the delicate balance between maximum production and minimum maintenance costs. Here the radiation pyrometer serves an extremely useful purpose.

The most obvious method of measurement is to sight directly on the roof, through either the front or the back wall. This will work quite well on many open-hearth furnaces, but on some units it is impossible to eliminate the effect of flame. In such cases a special brick, with a cross section in the shape of an H, is inserted in the roof. The horizontal member of the H is a relatively thin ceramic diaphragm, located behind the surface of the roof refractory. Since this diaphragm follows roof-temperature changes at a somewhat lower level, a proper arrangement of the optical system of the pyrometer makes it possible to indicate actual roof temperature by measuring diaphragm temperature.

Still another application of the radiation pyrometer in the open-hearth process is the measurement of checker temperatures. One method is to sight the detector directly on the top checker surfaces much the same as in the blast-furnace stove dome. On other installations the unit is sighted on the fan-tail arch. Both systems give very good results.

SOAKING-PIT TEMPERATURE MEASUREMENTS

The next step in the production of steel is the heating of the ingots in a soaking pit prior to rolling into blooms or slabs. Soaking-pit temperature measurement is extremely important because the ingot must be hot to the center to prevent roll breakage or surface defects, but, if the outside surface is overheated, the ingot can be easily "washed." Because of the high temperatures employed, radiation pyrometers are very practical for measuring soaking-pit temperatures.

The closed-end tube type of measurement is generally used. In this method the pyrometer sights into a closed-end refractory tube, which in turn is inserted into the soaking pit and attains its temperature. The pyrometer on the soaking pit must be located at a point where representative ingot temperature can be found. Some pits have the pyrometers in the side wall, others in the covers. In the latter case, cover motion requires that the instrument be able to withstand con-

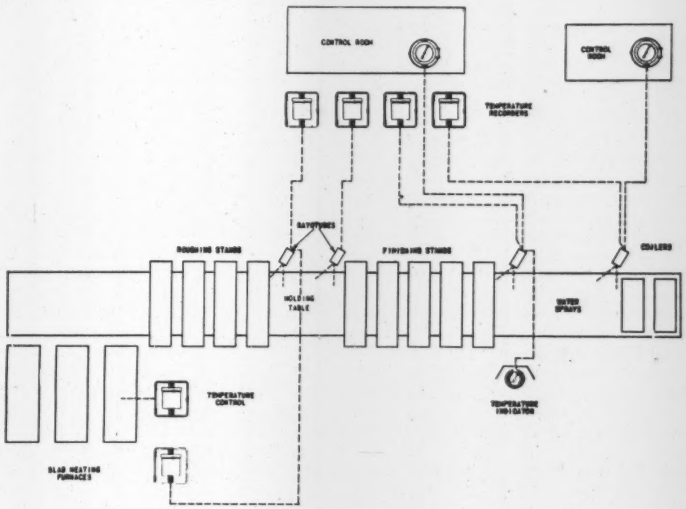

FIG. 9 SCHEMATIC VIEW OF RADIATION-PYROMETER LOCATIONS ON A HOT-STRIP MILL

siderable vibration, and some arrangement must be made for handling the leads. Satisfactory installations in covers prove the ruggedness of modern radiation pyrometers.

Between the soaking pit and the final finishing there are many rolling operations and reheating furnaces. The temperature during rolling operations is important since it affects the physical properties of the steel. Since rolling speeds are often very fast, detectors with unusually short-time constants are needed, in conjunction with high-speed recorders. Here radiation pyrometers are ideal since they measure the temperature without physical contact, and combinations of detectors and recorders are available that indicate the temperature in less than 2 sec. Fig. 9 shows radiation-pyrometer installations in a typical hot-strip mill. Other rolling operations are similar, the number and location of detectors depending on the particular operation.

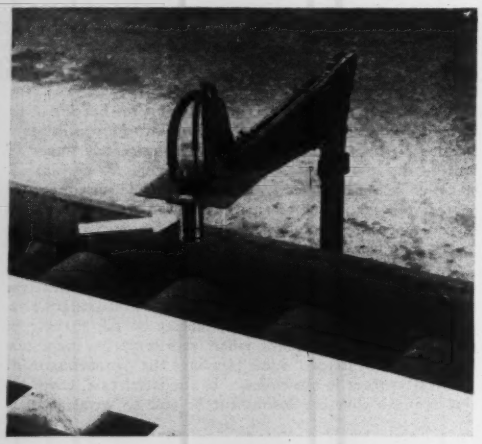

FIG. 10 RADIATION PYROMETER MEASURING SHEET TEMPERATURES

Figs. 10 and 11 show rolling temperature applications. The arrow in each illustration points out the radiation pyrometer.

TEMPERATURE MEASUREMENT IN REHEATING FURNACES

Just as the various rolling functions are similar, so the temperature-measuring problems in the reheating furnaces used prior to rolling are similar. Formerly the temperature of the furnace itself was considered sufficient, and was taken by thermocouples or by radiation pyrometers sighting upon closed-end tubes. While this type of measurement is satisfactory where the furnace production rate is low and the work has time to soak out to furnace temperature, it leaves much to be desired on the modern, large, high-production, high-heat head type of furnace. On such furnaces measurement and control of the actual work temperature is essential.

Work temperature in a reheating furnace can be measured by radiation pyrometers if proper precautions are taken. If a pyrometer is sighted indiscriminately into an oil or gas-fired reheating furnace, much of its output can be due to the flame. Therefore the sighting path of the instrument must be shielded from the flame.

One answer is a sighting tube inserted through the roof of the furnace, with a flared section at the hot end to shield the work from flame reflections. Measurements made this way are reliable, but tube maintenance is often a problem. A cobble might damage the tube, or, if severe, injure the furnace roof itself.

Another method is to mount the detector in the side wall and sight it on the end of the work through an open-end tube located at the point of minimum flame. The work must be

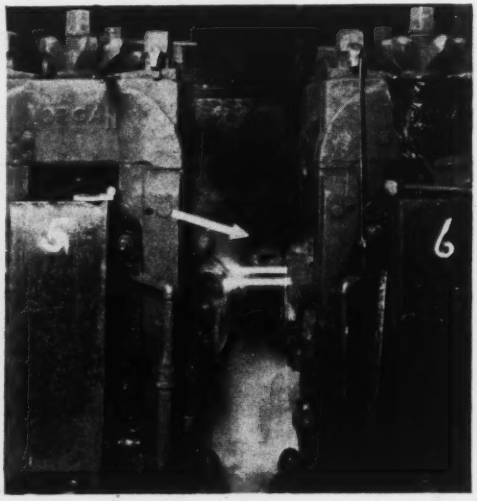

FIG. 11 RADIATION PYROMETER MEASURING ROD TEMPERATURES IN A ROD MILL

aligned at the instrument side of the furnace so that the open-end tube can extend inward as close to it as possible. With these precautions the effect of flame is minimized, and readings sufficiently reliable for automatic control are obtained.

Radiation pyrometry also makes possible the use of continuous annealing, tinning, and galvanizing lines. Formerly these operations were performed in batch-type processes, but with the pyrometers to control actual work temperature by regulating speed, heaters, or both, continuous high-production lines can be operated economically.

CONCLUSION

This paper has been elementary and necessarily brief, but the author hopes it has given some idea of what a radiation pyrometer is, how it works, and where it can be used in the manufacture of steel. Readers interested in pursuing the subject further will find more comprehensive details in the following: "Pyrometry of Solids and Surfaces," by R. B. Sosman, American Society for Metals, Cleveland, Ohio, 1940; "The Black Body," Benford, *General Electric Review*, vol. 46, 1943; "A Radiation Pyrometer for Open-Hearth Bath Measurements," by H. T. Clark and S. Feigenbaum, Trans. AIME, vol. 167, 1946; "Temperature Measurement in Basic Arc Furnace," by C. B. Post and D. G. Schoffstall, *Journal of Metals*, vol. 1, no. 10, October, 1949 (sec. 1), p. 12–7.

It is worth repeating that modern radiation pyrometers are rugged and stable instruments, which can be used for obtaining temperatures of moving objects without physical contact, and temperatures above the safe limits of other detectors. They are playing a vital part at many locations in modern steel mills, and it is expected that the future will see their use still more widespread.

The Application of CUTTING FLUIDS *to* MACHINING OPERATIONS

By R. B. NIEBUSCH and E. H. STRIEDER

THE CINCINNATI MILLING MACHINE COMPANY, CINCINNATI, OHIO

INTRODUCTION

THE main performance functions of cutting fluids, as used in machining, are the removal of heat from tool, chip, and workpiece, and the reduction of rubbing friction between chip and tool. In addition, an adequate supply of cutting fluid helps to flush the chips away from the cutting zone. These functions, when properly performed, result in such benefits as improved tool life, better surface finish, lower power consumption, and greater accuracy. However, a cutting fluid can perform its functions efficiently only when it is applied properly. If the full benefits possible with modern effective cutting fluids are to be obtained by the user, a large volume of clean fluid must bathe the actual cutting zone at all times.

GENERAL PRINCIPLES

This matter of the effective application of a cutting fluid is one which has often been sadly neglected. Yet the small expense necessary to achieve or maintain proper conditions of cutting-fluid application in production operations will be offset quickly by the resulting increase in production and improved quality of the product. In addition, many operator complaints will be eliminated.

The cutting-fluid supply system on a machine tool should be so arranged that the operator does not have to adjust or tamper with the supply lines in order to direct the flow to the cutting tools while operating the machine. These supply lines should be adjusted to provide an abundant supply of fluid to the cutting tools at the time the machine is being set up, and then fastened in position, to remain there for the duration of the job.

Experience has shown that, in general, best results are obtained by supplying the cutting fluid to the cutting tools in a copious flow, with little or no pressure. An abundant supply of fluid at very low pressure assures that the machining operation will be bathed in the fluid without the possibility of the stream being deflected from the actual cutting zone and without the objectionable splashing which often accompanies the use of high pressure. However, an exception to this may occur in such applications as drilling, reaming, and tapping, where fluid can be supplied under pressure through the shank of the tool without danger of splashing or being deflected.

Many machine tools in use today can be made more efficient by a simple rearrangement of their cutting-fluid supply systems, by providing larger piping with a relief valve in the system, and by removing restrictions to get maximum nozzle flow at low pressure. Where more than one outlet is used, as with multiple tools, a flow valve should be placed in each line to control the quantity of fluid necessary to suit the requirements of each cutting tool.

Contributed by the Research Committee on Cutting Fluids and Production Engineering Division and presented at the Annual Meeting, New York, N. Y., November 26–December 1, 1950, of The American Society of Mechanical Engineers.

As to the amount of fluid, the present study established the following simple "rule of thumb" which was found to give adequate results:

Gallons of cutting fluid per minute = maximum horsepower required for cut

It is recommended that this rule be adhered to wherever possible on production operations, provided that the piping does not become too cumbersome for the machine setup.

The general effectiveness of a cutting fluid also can be increased by the proper arrangement of the discharge from the relief valve into the supply tank, when such a valve is used. This can be done by so arranging the discharge from the relief valve that it will flow into the most remote area of the supply tank. This arrangement will agitate the cutting fluid and keep it circulating, so that the entire volume of fluid in the tank will pass through the supply system more regularly. In addition, this mild agitation will tend to reduce rancidity and bacterial growth, help to maintain emulsion stability over a longer period of time, and distribute the heat absorbed from the cutting operation uniformly throughout the whole body of fluid in the supply tank.

APPLICATIONS ON LATHE-TYPE OPERATIONS

The fundamental principle that should be followed on horizontal-type turning and boring machines is to direct the flow of

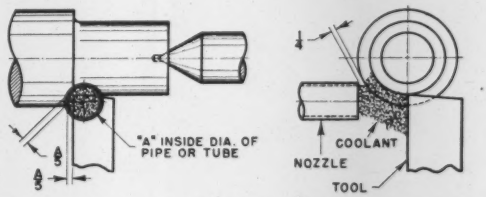

FIG. 1 IN TURNING OR FACING, CUTTING-FLUID SUPPLY NOZZLE SHOULD HAVE AN INSIDE DIAMETER AT LEAST 3/4 WIDTH OF TOOL (It should be located directly over and close to zone of actual chip formation.)

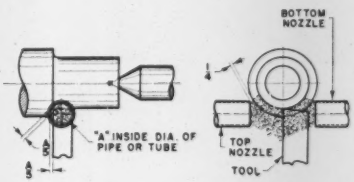

FIG. 2 IN HEAVY-DUTY TURNING OR FACING, AN ADDITIONAL NOZZLE SHOULD BE USED TO SUPPLY CUTTING FLUID FROM BELOW TOOL, IN ADDITION TO SUPPLY FROM ABOVE

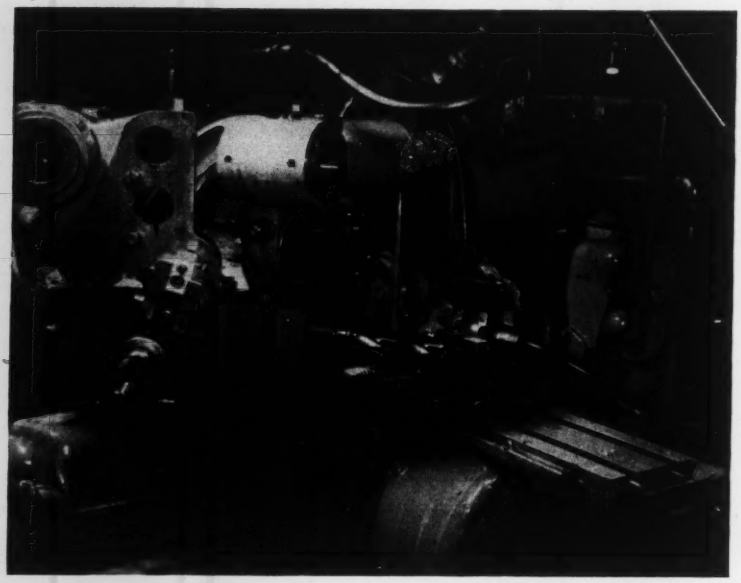

FIG. 3 ON MULTIPLE OPERATIONS, EVERY ACTIVE CUTTING TOOL SHOULD HAVE ITS OWN AMPLE SUPPLY LINE, WHICH SHOULD BE FIXED IN PLACE AT TIME MACHINE SETUP IS MADE

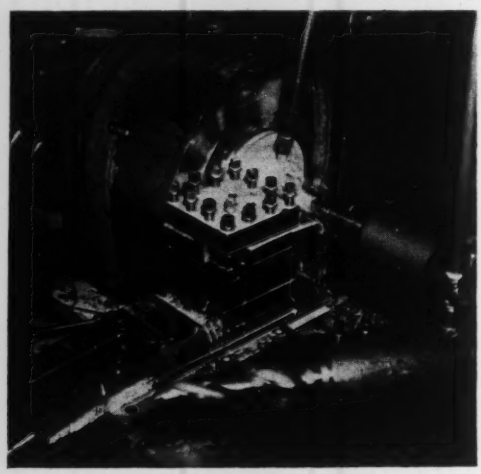

FIG. 4 HOLLOW-SHANK DRILLS AND REAMERS, WITH CUTTING FLUID SUPPLIED TO THEM UNDER PRESSURE, SHOULD BE USED ON HORIZONTAL MACHINES

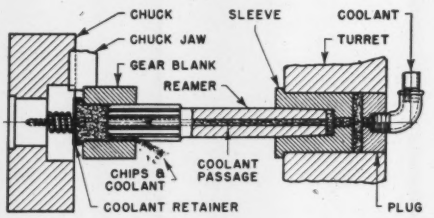

FIG. 5 FOR DRILLING, REAMING, OR TAPPING THROUGH-HOLES WITH HOLLOW-SHANK TOOLS, A CUTTING-FLUID RETAINER ASSURES THAT ALL CUTTING EDGES WILL BE FLOODED AND THAT CHIPS WILL BE FLUSHED FROM HOLE

cutting fluid, by piping, onto the cutting tool in such a manner as to submerge the portion of the tool that is producing the chip. Should it be found that a tool has to be inverted or in a position that is not horizontal, the flow to that tool should be metered by a valve in the supply line, so that the cutting fluid is under enough pressure to force it to submerge the cutting edge and the chip. Some of the general principles involved are illustrated in Figs. 1, 2, and 3.

For drilling and reaming on horizontal machines, much better tool performance will be gained by using so called "oil-feed" drills and hollow-shank reamers, such as shown in the foreground of Fig. 4. Drills and reamers of this type transmit the cutting fluid to the cutting edges and flush the loose chips out of the hole, as illustrated in Fig. 5. Should a machine not have a cutting-fluid supply to the turret-tool positions a coolant distributor should be provided, as shown in Figs. 6 and 7.

When chasing and tapping operations are performed on horizontal machines, consideration should be given to directing the cutting-fluid flow to the very cutting edges of the tools. Experience has shown that when using a die head with chasers, a copious flow of cutting fluid directed into the die head (onto

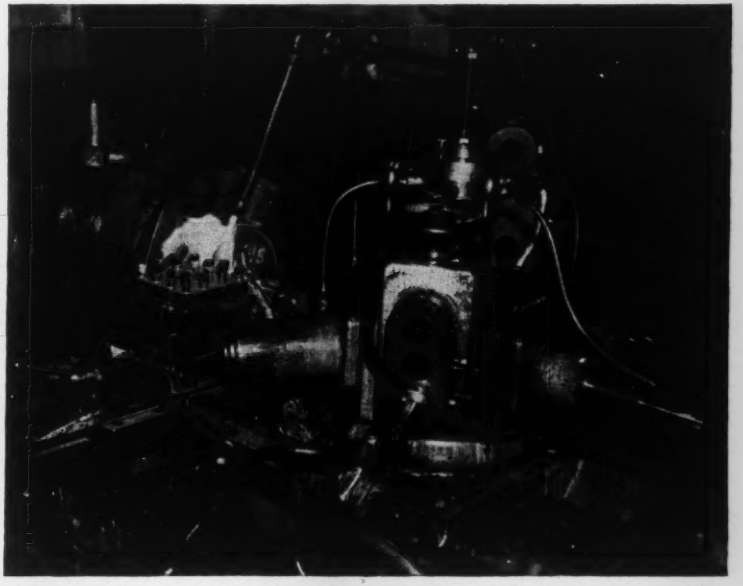

FIG. 7 A SIMPLE CUTTING-FLUID DISTRIBUTOR WILL QUICKLY PAY FOR ITSELF IN IMPROVED TOOL LIFE AND PERFORMANCE

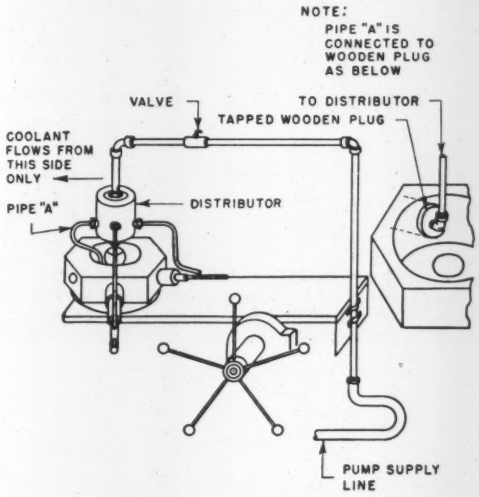

FIG. 6 FOR MACHINES NOT EQUIPPED WITH A SUPPLY SYSTEM TO TURRET, A CUTTING-FLUID DISTRIBUTOR SHOULD BE PROVIDED

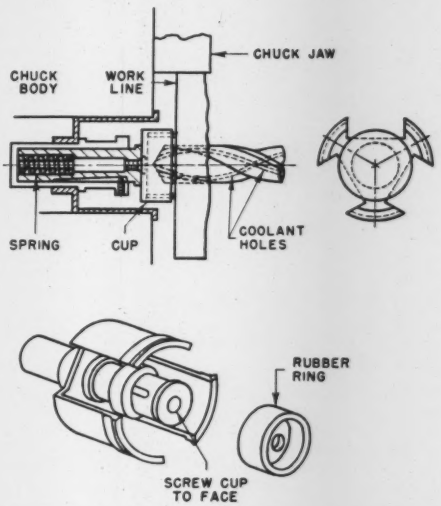

FIG. 8 DETAILS OF A SIMPLE CUTTING-FLUID RETAINER FOR USE WHEN DRILLING, REAMING, OR TAPPING THROUGH-HOLES

each chaser) produces threads of more uniform accuracy and better finish. In addition, the life per grind on the chasers is increased about 40 per cent, in terms of pieces produced, and the chips are washed out of the die head.

Whenever a workpiece requires a through-hole, as in the case of some chucking work, for example, it is advantageous to use a cutting-fluid retaining arrangement, such as those illustrated in Figs. 5 and 8. Such arrangements can be applied to drilling, boring, reaming, or tapping. When machining castings or

forgings having a cored hole, the cutting fluid can be applied through the spindle from the rear and into the retainer. This method is extremely helpful when core drilling and reaming deep holes. Here, pressure can be used that will adequately wash the chips out through the flutes of the tools. An example of such a cutting-fluid supply arrangement is shown in Fig. 9.

The job shown in Fig. 3 was formerly set up using one vertical coolant nozzle for all turning and facing tools. By applying cutting fluid as shown, tool life was increased 30 per cent. The surface finish, accuracy, and uniformity of the work were also increased, and practically all the smoke and steam formerly generated were eliminated.

OTHER TYPES OF MACHINING OPERATIONS

In cutting-fluid applications on milling operations, particular attention should be given to slab milling and face milling. In slab milling, the flow of cutting fluid should be directed to both the "incoming" and "outgoing" sides of the cutter, by means of flat fan-shaped nozzles on each side of the cutter, using valves to meter the flow to each of these nozzles. The width of these nozzles should be about $^3/_4$ the length of the cutter. These principles are illustrated in Fig. 10. Many

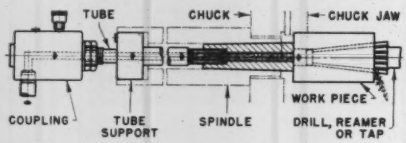

FIG. 9 WHEN MACHINING CASTINGS OR FORGINGS HAVING A CORED HOLE, CUTTING FLUID CAN BE APPLIED THROUGH THE SPINDLE FROM REAR

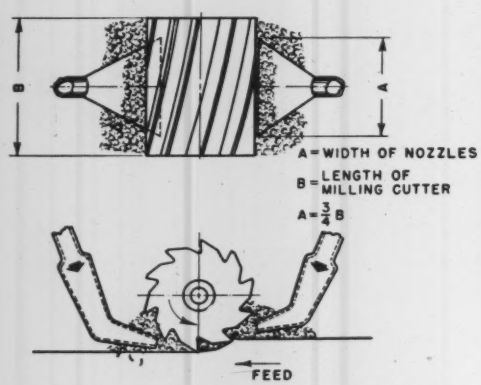

FIG. 10 IN SLAB-MILLING, FLUID SHOULD BE SUPPLIED TO BOTH SIDES OF CUTTER BY WIDE FLAT NOZZLES

old machines still in use today have adequate cutting-fluid supply systems to facilitate these applications. In the case of face milling, both vertical and horizontal, it is advantageous to supply cutting fluid to the cutter by means of a ring-type distributor, as shown in Figs. 11 and 12. A distributor of this type can direct as many streams of fluid onto the cutter as desired, thereby keeping each tooth in the cutter fully immersed at all times. The life per grind of the cutter shown on the job

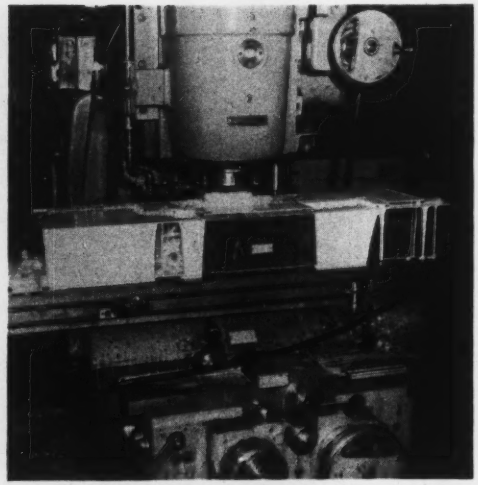

FIG. 11 IN FACE-MILLING, IT IS ADVANTAGEOUS TO FLOOD CUTTER BY USE OF A RING-TYPE DISTRIBUTOR

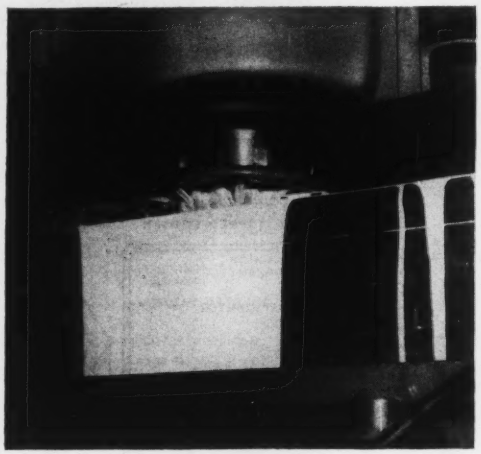

FIG. 12 WITH RING-TYPE DISTRIBUTOR, EACH TOOTH IN CUTTER IS FULLY IMMERSED IN CUTTING FLUID AT ALL TIMES

in Fig. 11 was increased over 100 per cent by changing from the use of only one coolant nozzle to the method of application shown.

The application of cutting fluid to hole broaching can be done effectively by using a distributor of the type shown in Fig. 13. Such distributors can be made to suit various types and sizes of spline broaches as required. The use of a distributor of this type assures that the pockets between successive broach teeth will carry an adequate quantity of cutting fluid into the hole, thus providing proper cooling and low chip friction.

Cutting-fluid applications on vertical machine tool opera-

tions such as drilling, reaming, and tapping can be improved also by use of the type of distributor shown in Fig. 13.

GRINDING

The correct application of cutting fluid to grinding operations is of utmost importance. In such operations it is essential that the workpiece be kept cool, the grinding wheel be kept clean, and lubrication be provided for the chips as they form. A cutting fluid, when properly applied, will perform all three of these functions.

The cutting fluid must be applied in large quantities under very little pressure. The machine piping should be large enough to carry the required volume of cutting fluid, and the nozzle so designed as to offer the least possible restriction to the flow of fluid.

The application of cutting fluid on most center-type and

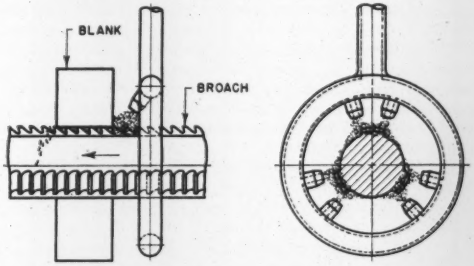

FIG. 13 USE OF A CUTTING-FLUID DISTRIBUTOR IN HOLE-BROACHING FILLS POCKETS BETWEEN BROACH TEETH WITH FLUID
(Vertical drilling, reaming, and tapping operations also can be improved by use of similar distributors.)

centerless-grinding operations is usually done in a satisfactory manner. Such an application is illustrated in Fig. 14. However, there are occasions when the operator will partially close the valve in the supply line, to keep from being splashed. This condition can usually be corrected by adjusting the nozzle to a more satisfactory angle with respect to the wheel face. In some extreme cases, a special splash guard is the solution.

The most difficult parts to cool properly and grind rapidly without burning are hollow rolls and tubing. The thinner the wall, the harder it is to dissipate the heat produced by the grinding wheel. However, many workpieces of this type can be filled with the cutting fluid and the ends plugged to retain that fluid. This procedure greatly reduces the grinding time required, and a much more accurate part is produced with a better surface finish.

Internal grinding presents a more difficult problem in cutting-fluid application. Here the cutting fluid must flush the chips removed from the work, and the grain and bond worn from the grinding wheel, out of the hole being ground. It is considered good internal-grinding practice to use as large a grinding wheel as possible, and this condition makes it very difficult to get a large enough amount of cutting fluid into the hole to cool the work and keep the grinding wheel clean. A compromise must be made between the size of grinding wheel used and the amount of fluid flushing through the hole. In addition, as large a diameter as possible should be used for the supply tubing. The outlet should be positioned to so direct the cutting fluid that it will be dragged between wheel and work by the rotation of the wheel. Workpieces with a hole through them will permit cutting fluid to be applied through the work-head spindle from the rear, in the manner shown in Fig. 9. This makes a very satisfactory application.

Most surface-grinding operations on reciprocating table-type machines can be improved greatly by using two nozzles rather than the one that is commonly used. On this type of machine, when one nozzle is used, an adequate amount of cutting fluid is applied when the table and work move in one direction; when the table and work move in the other direction, no fluid is available until after some grinding is done. The amount of cutting-fluid starvation that takes place depends upon the diameter of the grinding wheel. This condition causes the workpiece to heat and results in a premature failure on the cutting face of the grinding wheel. A supply system similar to that shown in Fig. 10 is the answer to this problem.

The cutting-fluid tank on a grinding machine should be kept full at all times. A high level in the tank will permit a better settling-out action to take place and, in addition, the cutting fluid will be cooler.

To summarize, the direct application of a large quantity of clean cool cutting fluid under very little pressure to any type of

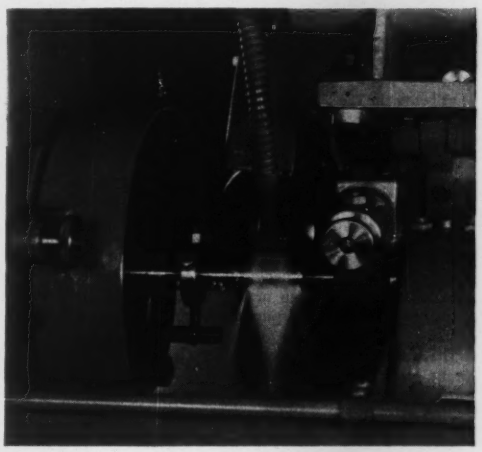

FIG. 14 IN GRINDING, ENTIRE CONTACT ZONE BETWEEN WHEEL AND WORK SHOULD BE FLOODED WITH ABUNDANT SUPPLY OF CLEAN COOL CUTTING FLUID

grinding operation will result in faster metal removal, better wheel performance, longer wheel life, more accurate parts, improved surface finish, and less scrapped work.

CONCLUSION

The results obtained in the present investigation emphasize the fact that, although modern effective cutting fluids are able to provide many moneysaving benefits in machining and grinding operations, often they are not being applied in such a manner as to obtain those benefits. Only when a large volume of clean fluid bathes the tool (or wheel) and the actual cutting zone are these benefits obtained. This important requirement can be met by making relatively simple, inexpensive modifications to the existing general-purpose cutting-fluid supply systems on many machine tools in use today, as described and illustrated. As a result, increases in tool life of as much as 100 per cent may be obtained, together with such other benefits as improved surface finish, greater accuracy, the reduction or elimination of steam and smoke, and the elimination of many operator complaints.

A Businessman's Responsibilities in REARMAMENT

By E. L. LINDSETH

PRESIDENT, THE CLEVELAND ELECTRIC ILLUMINATING COMPANY, CLEVELAND, OHIO. MEMBER ASME

THE word "crisis" has certainly become overworked in recent years, but the present period unquestionably qualifies. Moreover, the present crisis is one which probably will last indefinitely into the future before conditions return to anything like even that chaotic postwar "normal" to which we were becoming adjusted. I presume everyone agrees that things will never again be normal in the ordinary sense of the term.

Our economic system during this period is going to undergo increasing strains at the very time when it is the great hope of the world from both an ideological and a material standpoint. That being the case, we businessmen, who are important cogs in the workings of our economic system, must appraise those strains and gear to meet them.

Jim Nance, president of Hot-Point, aptly put it this way: "None of us has to be told that whatever is required of us in the conflict now being waged with international communism is our first obligation. There must be no business as usual, no unionism as usual, no politics as usual, no individual selfishness as usual, so long as a single young American is fighting international communism anywhere in the world...The requirements of rearmament are going to present overriding demands and responsibilities. These requirements must be fulfilled first, of course."

The Committee for Economic Development, in its excellent recent statement, "Economic Policy for Rearmament," set forth these four tasks which immediately confront the nation:

1 *Carry out the military program*, to be set by the President and translated by the military agencies into specific procurement schedules and orders.

2 *Strengthen our economy*, to meet whatever demands the future may put upon it.

3 *Avoid inflation*, which would impede the present program, weaken our future capacity, and injure the American people.

4 *Preserve our freedoms*, as the basis of our strength and the ultimate object of our efforts.

These responsibilities call for superb performance if we are to discharge them adequately.

INDUSTRY, THE KEY TO PROTECTION

It need scarcely be mentioned that industry is the key to our protection from external aggression in a period such as the present. Preparedness is, in final analysis, industry's job.

But we've got far more to do. Despite the inherent difficulties we inevitably face in a period such as this, we must strive to maintain the basic structure and principles of the system which has given the nation its fundamental moral and economic power.

The electrical industry is the only one in which I have ever worked. I'd like to use it as a sort of case study to illustrate the part industry is now called on to play, and the obligations industry has toward the welfare of the nation.

It is an industry characterized by large investments. Total electric plant and property account, including government-owned facilities, was $21.3 billion at the end of 1949. It is thus the third largest industry on an investment basis in the country.

The industry's investment is also very high per employee, per dollar of annual revenue, and per customer. For example, property and plant investment per employee is about as follows, compared with a few other industries: department stores, $4000; iron and steel, $10,000; telephone, $15,000; electric utility industry, $60,000.

Our industry's revenues, though, are small. In 1950 they'll be only $4½ billion. By way of comparison, revenues of General Motors alone will be over $7 billion. The electric-utility industry's net income will be about three quarters of a billion dollars, less again than General Motors alone.

There is much misunderstanding and some misrepresentation with regard to the availability of electric service, which now extends practically throughout the United States. At the year-end, service was available to 93 per cent of the nation's farms, and to 97 per cent of all occupied homes, urban and rural, although some of our less populated farm states still have a substantial rural job to do for which REA funds have been adequately appropriated by Congress.

Business-managed companies supply power for 85 per cent of all customers—and supply 80 per cent directly. These companies directly serve about one half of the nation's farms and REA co-operatives almost the remaining half, with the small remainder being served by municipalities or other governmental agencies. REA's, generally speaking, buy their power from "private" companies.

Just as the industry is not large revenuewise, neither is it a large industry in so far as employment is concerned. Business-managed companies have a total of 290,000 employees, the Government about 50,000, for a grand total of 340,000. So, as one can see, some large companies outside our industry have more employees in themselves than the entire electric industry the nation over.

The electric-utility industry is likewise illustrative of industry's problem from a growth angle. It is probably growing faster than any other large industry, although this kind of flat statement depends, of course, on the basis of comparison and also on such things as what is included in the term "industry."

By the end of 1951, the electric-utility industry will have a capacity of 75,000,000 kw—almost double the 1939 figure of 38,800,000 kw. Twenty-five million will have been added in six years postwar—a 64 per cent boost in that time alone.

By comparison, the steel industry, which has received much notice of late because of announced expansion plans, will have increased its capacity only about 31 per cent over the period 1939-1951. The oil-industry capacity has been stepped up about 65 per cent in the last 10 years.

It takes money to grow in our business as well as in others,

Presented at the Joint Fuels Conference of the ASME Fuels Division and the AIME Coal Division, Cleveland, Ohio, October 24-25, 1950.

and during the eight years ending in 1953, the electric companies will have spent 12 billions for expansion, doubling the investment they had at the end of 1945. They spent 2.2 billions in 1950 alone.

OUTLOOK FOR GROWTH IN ELECTRICAL INDUSTRY

The outlook for growth of the electrical industry in the next two decades is breath-catching. Use of electric energy by all classifications of customers is soaring—the number of customers is increasing all the time, with technological progress in developing new uses at an all-time-high rate.

If the industry grows in the next 20 years at the rate of the last 20—and this is reasonable—we can look forward to these facts:

1 By 1970 power-plant capacity will have tripled to more than 200,000,000 kw, against 64,000,000 kw today.

2 By 1970, annual sales of the American electric-utility industry will be 800 billion kwhr—about triple 1950 estimated sales of 275 billion kwhr, and far greater than the entire world's output in 1949.

3 By 1970, property and plant will be 65 billion dollars, three times today's 22 billion. This 1970 figure will just about equal the combined investment today in the railroad, petroleum, steel, and coal industries.

This sketchy picture of one industry is offered only to show the importance of industry in general in our American scheme of things. The electric-utility industry is only one of many. But like many others, it is an industry which is equally essential to rearmament and to the development of the nation's civilian standard of living.

As a consequence, while we are rearming, the people will expect full civilian service while we are also providing for large increases in the use of power for aluminum, magnesium, electrochemicals, and a host of other components for war. This dual responsibility is part of the larger problem, which is paramount, namely, preserving the elements of the American system without which we have nothing. That system today and in the immediate years ahead faces strains more severe, I personally believe, than the strains of all-out war.

ECONOMIC DANGERS OF EMERGENCY PERIOD

I am sure the reader is familiar with the nature of some of these strains. Prof. Sumner Slichter of Harvard has pointed out three of them; three specific ways in which our economy may be weakened in a period such as the present:

1 *A speculative boom may arise*, which would produce many injustices and much unrest, and which might end in collapse and severe unemployment. The recent FRB credit restrictions are just the beginning of what it is going to take to hold inflation in check.

2 *The standard of living may become stagnant* because of the diversion of our production to military purposes and to foreign aid, with the result that social unrest and discontent with American institutions would be fostered. However, the urgency of the time may accelerate expansion of our productive capacity, stimulate research, and lead to greater labor productivity.

3 *Tax rates may become so high that enterprise will be stifled*, expansion of industry retarded, and high employment blocked.

These economic dangers, and the other critical factors that are always at work in wartime, are menacing for one basic reason; they may bring about conditions which will result in the loss of the very things we are fighting for. We may truly "kill the goose that lays the golden egg."

Freedom of choice, the sovereignty of the individual, is, of course, the great American principle which is most endangered. Yet, mobilization and rearmament necessarily mean giving up temporarily some of our rights and privileges. But we do have a responsibility to insist that restrictions go no further than necessary at the time, and that they be limited to the duration of the emergency.

In view of the likelihood that the emergency will continue indefinitely, however, it will be difficult to enforce such qualifications. Doing this will call for the best efforts of all of us. But even while we submit to unavoidable curtailment of freedom of action, we can be working to keep the attention of others focused on basic American principles so that when the emergency is over, the various measures that inevitably trend toward statism will be reversed.

MAINTAINING OUR BASIC ECONOMIC SYSTEM

Again, the utility industry illustrates a number of the particular problems involved in maintaining our basic economic system—problems which point up some of the difficulties of preserving that system. But the steel industry, or coal, or railroads, or a number of others, might also serve as the example.

There is competition from the Federal Government with which readers certainly are familiar. The risk is great that further attempts at socialization of the power industry will accompany rearmament.

The same is true in other industries, and the power to build competing government industrial plants is included in the new defense law.

The basic problem of public misunderstanding of this piecemeal socialization of the power business has been nicely pointed out by Opinion Research Corporation in a recent survey. It showed that the vast majority of Americans are opposed to socialism, and that a majority of them recognized the TVA, for example, as socialistic. Yet many of them are still in favor of TVA.

This is the hazard America faces, this piecemeal socialization—the hazard of gradualism. And we as businessmen face a responsibility to point it out.

ESSENTIAL RESULTS FOR BUSINESS TO REALIZE

Now, in view of this unfriendly climate in which American business is called upon to operate, what are our further responsibilities as businessmen? I won't attempt to cover them all, but here are some essentials as I see them:

First, we've got to run our own businesses successfully. As Donald Kirk David, dean of the Harvard Graduate School of Business, has said: "It is unrealistic to presume that the business leader can discharge any other responsibility if he fails in this, his foremost job."

We have got to earn adequately to insure that we can raise the funds for the expansion of our industrial machine, whether we be in steel, or railroads, or oil, or any other industry.

Then we must support the various control measures required in an abnormal economic period such as the present. We will not be able, for an indefinite period, to improve standards of living as fast as we might have or would like to do.

Our individual actions as businessmen have important national and international significance. Long before the Government came out with its latest stringent regulations, the CED, in its research report on "Economic Policy for Rearmament," set forth six points to guide businessmen. These guideposts are valid regardless of what the government requires. They are:

1 Assure the availability of materials and plant for military production.

2 Intensify efforts for more efficient production.

3 Keep inventories at reasonable levels.

4 Hold prices down—we must not raise prices in anticipation of higher costs.

5 Assist in promoting the Saving Bond program.

6 Curtail excessive or speculative credit expansion.

Another broad responsibility—and the one I regard as the most important—is *to intensify our efforts in the field of executive development.*

EXECUTIVE MANPOWER DEFICIENCIES

This need for developing executive manpower is common, of course, to all industries, in peacetime or wartime. But in a period of crisis the need for responsible, socially minded executives, with a broad outlook, is more urgent than ever. And these executives aren't developed overnight.

A recent study by the National Industrial Conference Board "Company Programs of Executive Development"—and I recommend it for reading—pointed out:

"In the past it was said, 'When the president dies, we hire a new office boy. Everyone moves up...Honesty, sobriety, and hard work are the qualities an ambitious employee needs to get ahead...Experience is the best teacher...Going to night school helps...The cream will rise to the top.'

"Now, thoughtful businessmen are asking if the old system can be followed much longer with safety. Of course, character and ambition are still important in business and they always will be. So are the efforts made by the individual, both on and off the job, to improve himself. The question is: Are these things enough? Or have changes occurred in business and in society that call for a re-examination of our basic assumptions?"

It is pretty obvious that they have. For example, a recent study, by Booz, Allen & Hamilton, of top-management ages in 65 diversified companies showed that the average age of executives is rising. Twenty years ago, the average age of presidents of companies surveyed was 53; today it is 59. Senior officers averaged 48 years of age in 1929, 55 in 1949.—Replacements for these senior officers averaged 52 years in 1949; this for industry, in general.

A recent survey in the electric-utility industry showed that the average age of the top five operating utility executives in the companies reported on was 57 years. One in eight was 65 or older. Four in 10 were 60 or over. Two out of three were 55 or over.

Two out of three of the industry's top executives will be succeeded by someone within ten years if they retire at the "normal" age of 65. It is a real question whether our industry is developing these successors, or even recruiting the raw material.

COLLEGE GRADUATES NOT ATTRACTED TO UTILITY INDUSTRY

What is the attitude of young graduates toward our industry? A recent survey again showed that the electric industry has paid too little attention to college graduates—and vice versa. We just haven't sold the industry as a place to make a career. And, mind you, this is the fastest-growing industry expansion-wise in the country.

College men have these unfavorable impressions of the industry:

1 Salaries are too low.

2 There are too few good training programs.

3 The opportunities for advancement are too limited.

4 The industry has too many Civil Service type disadvantages.

A pretty good index is provided by the career-preference survey of this year's graduating class of the School of Business Administration at Harvard, which disclosed that not one of 500 men in the class had any desire or intention to enter the electric-utility business.

And these are the leaders of tomorrow's business! Yet we have failed to interest them in the industry which is going to be by all odds the largest in the country when they reach the peak of their performance 20 or 30 years from now.

It is quite obvious that if we are to avoid trying to operate with second-rate manpower, we've got a job to do.

The same situation prevails in other important industries. As businessmen we have a responsibility to see that industry generally gets its share of good manpower, in order that we can discharge the obligation we have in keeping industry strong.

What is the situation salarywise? Are the boys correct in feeling that our salaries are too low? The answer is "yes."

A survey three years ago among electric companies showed top-executive salaries were much too low to be competitive with those paid elsewhere. Among companies with property accounts as much as $250,000,000 or more, the chief executive's annual salary was as low as $45,000, with others correspondingly low. It was estimated at the time, for example, that there were a number of large nonutility corporations in the United States with more $20,000-a-year men than in the entire electric-utility industry.

Yes, I think the boys are probably right in many cases. Although we are making some progress in improving the situation, still a 1950 recheck of the same companies we surveyed three years ago showed very little change in salary conditions. Many large industries are just as weak in this regard. Hence, as businessmen, we must recognize the responsibility of providing adequate incentives to get the manpower we need.

OUR RESPONSIBILITY TO HIGHER EDUCATION

One of our people recently made a study, from opinion surveys available, of the extent of misunderstanding and misinformation among both students and teachers. The results were quite shocking—almost terrifying. This material was incorporated in a talk I recently made, entitled "A Businessman's Responsibility to Education."

In that talk I pointed out that there are many evidences that the colleges today are failing in what is perhaps their greatest single objective. It was described by President Harry N. Wright of the College of the City of New York, in these words: "To focus the whole life of the institution about the goal of educating a citizenship with character capable of steering our social, economic, and political development in the channels of democracy."

A good case can be made that businessmen have a major responsibility for the fact that both college students and their teachers are ill-informed about the American business system and its contributions to the nation. Being ill-informed, these students and teachers often are also antagonistic.

If we are to do our share in offsetting this misinformation and misunderstanding, we businessmen must:

1 Insist to our academic friends and in our hiring practices that college students be given a well-rounded preparation for effective American citizenship as contrasted with narrow specialization in limited fields.

2 Attend—and urge our associates to attend—advanced education courses which stress the social responsibilities of business.

3 Supply scholarships, laboratory equipment, plant-tour programs, and teaching aids.

4 Provide temporary jobs for college students and consultant positions for professors.

5 Furnish the financial support required for higher college salaries and better college facilities.

(*Continued on page 232*)

PLASTICS LITERATURE REFERENCES

Selected for the Mechanical Engineer—July, 1949, Through June, 1950

By H. M. RICHARDSON

DeBELL & RICHARDSON, INC., HAZARDVILLE, CONN. MEMBER ASME

THIS is a review of the advances in plastics, July, 1949, to June 1950, which are of interest to mechanical engineers. The accompanying Bibliography does not contain all of the articles on plastics which appeared in the technical literature during the year, but only those which, in the opinion of the author, would be of direct or indirect interest to the engineer. On the other hand, it would not be true to say that all of the writings here mentioned are new. Each one, however, appeared to have more or less of new matter which is of interest. The subdivisions in which the references are grouped are arbitrary and serve to put together items which may be of a common interest.

NEW MATERIALS

A new family of synthetic resins, the epoxy resins or ethoxylines have appeared in the United States from two manufacturers. They are characterized by a high degree of reactivity with resin-forming esters, condensation resins, and polyamines to form adhesives, surface coats, casting or potting resins, and impregnants with a high degree of heat stability, very low shrinkage, and extraordinary adhesion (1).[1] The veil of secrecy has been generally removed now from the fluorocarbon polymers and particularly the fluorovinyl chloride or polytrifluorochloroethylene which is noted for its good electrical properties coupled with resistance to high temperature (2). It is a thermoplastic which is moldable in the range 250 to 300 C, and is almost as resistant to chemical attack as is its older brother tetrafluoroethylene (Teflon). Now referring to plastics which are electrical conductors instead of electrical insulators, a new class of materials designation as Markites are made with controlled resistivity (3, 4).

Earlier work in mixtures of synthetic rubber of the nitrile type with phenolic resins has been published previously. These mixtures are now finding valuable commercial applications in a line of filled and unfilled compounds and adhesives (5).

Most of the polyethylene which is produced is in high-molecular-weight material and finds its way into sheet, film, monofilaments, insulation on wire, blown squeeze-bottles, and injection-molded parts; there are also fast-growing uses for low-molecular-weight polyethylene in paper coating, wrappings, and hot melts for the packaging industry (6).

In the field of silicone resins, the "bouncing putty" is beginning to find engineering applications, and new surface coatings are becoming available (7, 8). Also, there have been reviews of newer synthetic fibers (9), a new family of rayons based upon the reaction of viscose with acrylonitrile (10). Styrene has been copolymerized with unsaturated fatty acids in the formation of new types of protective coats (11). Flameproofing agents (12) and new developments in the field of dielectrics have been reviewed (13).

PROPERTIES OF PLASTICS: CHEMICAL, THERMAL, AND PERMANENCE

There is a good basic article on the physics and chemistry of adhesion presented before the Wood Industries Division of this Society which every engineer should read (14). Also, a new method of evaluation of adhesion through the use of ultrasonic vibration was disclosed (15). Valuable data will be found in a study of the permeability of polymeric films to organic vapors (16); the thermal conductivity of liquid silicones (17); and the effect of fuel immersion on laminated plastics (18).

The effects of deteriorating influences are discussed in a new corrosion test for plastics (19); a study of the crazing of cast polymethyl methacrylate (20); problems in fungus and moisture deterioration (21); the ignition and burning characteristics of glass laminates with phenolic, polyester, and melamine resins (22); methods of determining ignition characteristics of plastics (23); and of heat resistance in laminated plastics (24). Change in the characteristics of plastics, films, and sheets on heating is measured by a new and simple device (25).

PROPERTIES OF PLASTICS: MECHANICAL

One of the best articles in its field is one on the theory of mechanical properties of hot plastics which was presented before this Division last year (26). It is an admirable attempt to treat the phenomena of large elastic strain, relaxation, plasticity, and flow by mathematical means and provides the engineer with a better physical understanding of these phenomena. In another article (27) is treated the complex stressing of polyethylene in the formation of fibers by cold-drawing, as compared to the behavior of this material under biaxial or other complex stressing. Another mathematical study of plastic flow, dealing with calendering of plastic materials (28), was presented before this Society last year.

Long-time tensile-creep tests of both thermosetting and thermoplastic materials were reported for periods of time from 1000 to 14,500 hr (29). Additional data on the creep-time relations for polystyrene under tension, bending, and torsion were reported (30), followed by additional data covering the damping characteristics of plastics (31, 32). Another series of investigations is reported showing the mechanical properties of high polymers as affected by the molecular structure and the shape of the molecular-weight distribution curve (33, 34, 35).

Attention is also brought to a symposium on high-polymer physics, in which such interesting things as the mechanical properties of oriented polystyrene film, the effects of time and temperature in shear, creep, and recovery of the elastomers, and stress phenomena from respective viewpoints of solid states and high-polymer physics are covered (36).

For the study of strain and orientation in plastics, we have a

[1] Numbers in parentheses refer to the Bibliography at the end of the paper.

Contributed by the Rubber and Plastics Division and presented at the Annual Meeting, New York, N. Y., November 26–December 1, 1950, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

description of a photoelectric strain analyzer suitable for manufacturing control purposes (37), and an investigation of the use of polarized infrared radiation in the examination of structure and orientation of high polymers (38).

A section on low-temperature behavior of organic plastics is included in a symposium by the American Society for Testing Materials (39). Ultrasonic waves were found to cause a depolymerizing effect on such things as polystyrene and hydroxyethyl cellulose in solutions (40).

To get into the better-known field of materials testing, we have a report on investigations at the Materials Laboratory, New York Naval Shipyard, of shock resistance of molded thermosetting plastic materials (41). We also have ASTM papers on significance of Charpy and flexure tests in evaluating impact resistance of plastics which indicate that it takes both flexure and notched and unnotched impact tests to characterize plastic materials accurately (42). Another presents some notes on the effect of testing-machine characteristics on measured tensile properties of plastic films (43).

A new type of testing equipment for measuring and recording stiffness of nonrigid plastics is described (44), and there is a review of important points relative to the preparation of specifications for plastic materials as used in branches of the Federal Government (45).

TEXTILE FIBERS AND FINISHES

A progress report on plastic monofilaments includes the materials and their applications in this field (46). Another article deals with the use of polyethylene as a textile material, giving problems of production and use (47). The experience of the French with unplasticized polyvinyl-chloride monofilaments is discussed in another article (48).

Several articles were found relating to the use of synthetic-resin treatments in the finishing of fibers and fabrics (49, 50, 51, 52, 53, 54).

PAPER LAMINATES AND REINFORCED PLASTICS

Combinations of paper and synthetic resins in the form of flexible sheet were treated in five separate articles. These dealt with the theory of saturation of paper with resin (55), methods of combining phenolic resins and paper (56), some factors in the strength of paper (57), properties of flexible impregnated sheet (58), and a discussion of the testing problems of a paper-mill laboratory dealing with plastics (59).

During the past year the reinforced plastics generally made of glass fabric and polyester resins appeared to be getting on a paying commercial basis (60), and small boatbuilding of these materials approached mass production (61). Continuous laminating of low-pressure reinforced plastics was also discussed (62). Another process was described for the no-pressure molding of asbestos fibers impregnated with water-soluble phenolic resins (63).

In the field of laminated plastics insulation, we have a review of the present state of the art (64) and are told about a new line of fibrous materials which combine resin binders formed in place on the paper machines (65). In the field of structural plastics, we have a report on strength properties of rayon-mat honeycomb-core materials (66), and on honeycomb sandwich structures generally (67).

PROTECTIVE COATS

We found three articles on synthetic protective-coat resins. One of these reviews the properties, qualities and limitations, and applications (68); another gives the background data for the specifications of various organic finishes (69); and the third relates to the application of insulating varnishes (70).

COATING AND CALENDERING EQUIPMENT

There were two good articles on the equipment used for impregnating and coating of plastic materials on paper or fabric and including also the combining and doubling equipment to go with them (71, 72). Similarly, there were three articles on the plastic calender and its auxiliary equipment. One of these discusses up-to-date practice and design of calendering equipment (73). Another describes a beta-ray thickness gage for continuous gaging of sheet (74), and the third discusses the use of liquid heating and cooling as applied to drilled calender rolls (75).

PLASTIC MOLDS AND MOLDING

Each year a great deal is written on the subject of plastic molding, the design of molds, the design of parts, finishing problems, and so on. This year brought its share and included some of the following: An article on plastics design problems discusses the responsibility of the product engineer in the design of the molded part and the selection of proper materials (76). Another one discusses dimensional tolerances in plastic materials and products (77). External design factors make the product look well and mold well (78). Another article specifically discusses designing of plastics for major household appliances (79). A general review article on methods, materials, and design in plastic molding was presented (80); another, some examples of advanced design in plastic molds (81); and the use of beryllium-copper molds was presented (82). In the finishing of molded plastics, a general review of methods is presented (83), and a new method of blasting the parts with ground apricot pits to remove flash is described (84). Applied finishes such as metallizing under high vacuum (85), a discussion of the type of inks to be used on plastics (86), and of the surface dyeing of plastics (87) were discussed. Applications for molded plastics with low dielectric losses brings that subject up to date (88). There were also two articles on the economics of molded plastics, one of which covered cost factors (89), and the other reviewed cost and cost trends, compared to nonplastic material reduced to common weight and common volume bases (90).

VINYL FILMS AND SHEET

The production and use of calendered vinyl film and sheet has become so widespread and has grown into such large business that a series of articles were published relating to manufacturers and users of vinyl film; the problems of the vinyl-film fabricators; the improvement of vinyl-film products through better processes and equipment; new techniques, processes, and equipment for vinyl spread coating; and a discussion of the manufacture of sheet and film from plastisols and organosols (91). There were also articles on plastics in fabric coating (92) organosol formulations (93), polyvinyl-chloride pastes (94), and plasticizers for polyvinyl chloride (95).

An interesting new infrared heating panel made by combining electric heating elements into Fiberglas fabric has found some interesting applications (96). Gravure printing is commonly used on vinyl film. Some aspects of this are discussed (97). Other articles describe the use of polyvinyl-chloride pastes in the manufacture of protective clothing for industrial workers (98), and the use of polyvinyl chloride for lining in concrete sewer pipe (99).

INJECTION MOLDING

If the reader is interested in the injection molding of polystyrene, a good article on the behavior of polystyrene under various conditions of pressure, temperature, and time appeared recently (100). There are also other good articles on molding

of polystyrene (101), and considerable discussion of pin-point or restricted gating as applied to injection molds and molding (102, 103, 104). The reader probably has seen the integrally molded two-color keys on typewriters and adding machines. A description of an automatic two-color molding process is described (105).

In discussion of injection-molding equipment, one article deals with a machine which plasticates the material in an extruder before injecting (106), and another article by an astute molder suggests improvements in injection-molding machines (107).

EXTRUSION

One article here discusses factors in the design of an extruder and the characteristics of various types of screws, the provision of special wear-resistant, corrosion-resistant, cylinder liners, and problems of temperature control (108). Another article describes the problems which are encountered in presently available extrusion equipment and asks for certain improvements (109). Equipment used in the wire and cable industry for the extrusion of plastics on wire is discussed in some detail (110). Extruded polyethylene film is being used very widely. Basic details of the manufacture of this film by extrusion procedures, both as flat sheet and as inflated tube, are discussed (111). While, in this country, there has not been very much extrusion of unplasticized polyvinyl chloride, it has been quite widely used in Germany and England (112). Automatic control of the extrusion of insulation on wire is discussed (113). Extrusion of thermosetting materials is still under consideration here, although it has not taken hold to the extent it has in Europe (114).

The use of a double-meshed screw extruder for the compounding and extrusion of plastics on a commercial basis is described (115).

PLASTIC MATERIALS, USES

Good articles were published on properties and applications of rigid polyvinyl chloride (116) and on the present-day uses of polystyrene (117, 118). Polyethylene in its many uses is discussed in two other articles (119, 120), and another is devoted to the flame spraying of polyethylene coats onto metals to provide corrosion resistance (121, 122). Polyethylene as used in jacketing of telephone cables is also discussed (123).

Thermoplastic sheet materials are becoming more and more widely used. Rigid sheets of Royalite, a mixture of a thermoplastic resin with a synthetic rubber, find many applications (124). Also, corrugated translucent panels of methyl methacrylate or glass-polyester are used for windows in corrugated-metal buildings (125). Nylon as a bearing material has found a number of useful applications (126), and plastics are being used more and more for insulation and containers for batteries (127).

Following some successful work which was done during the war with casting resins for the encapsulation of subassemblies for electronic circuits, there has been a considerable advance for subminiature equipment and for plug-in units (128, 129). An unusual application for plastics is in lenses for focusing of ultrasonic radiation (130).

There were numerous articles on miscellaneous uses for molded plastics, including a review which compares plastics with metal in a number of cases where plastics have replaced metal (131). Also there are wide applications of plastics in refrigerators (132), in the textile industry (133), and in the plating shop (134).

In the foundry, synthetic resins have found a firm application in core binders (135), in the manufacture of a new type of casting molds (the Croning process) (136), and furane resins produced from furfural and furfuryl alcohol have found use in bonding sand molds (137). In another phase of foundry work, resins have been used as castings to make foundry match plates (138). No review of the plastics literature would be complete without mention of that tremendous compendium of plastics information—the 1950 Modern Plastics Encyclopedia and Engineer's Handbook (139).

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A HIGH molecular weight polyvinyl resin that can be processed without plasticizer has created a whole range of applications in the fields of structural plastics and wire and cable insulation for polyvinyl materials, according to B. F. Goodrich Chemical Company, Cleveland, Ohio.

Called Geon 404, the new resin is said to have the outstanding electrical, physical, and chemical properties of pure, unmodified polyvinyl chloride, and can be processed (extrusion, calendering, or molding) successfully into "rigids" on conventional plastics equipment.

Although unplasticized polyvinyl chloride has superior characteristics that should render it an outstanding rigid plastic, it has never enjoyed more than a small percentage of the total market. The principal reason for the low percentage has been the relatively poor processability of the vinyls currently available as compared with the polystyrenes, acrylics, cellulosics, etc.

Plasticizer addition in vinyl compounding has not solved this problem. Incorporation of plasticizer in high-quality rigid vinyl compositions has resulted only in impairment of physical, chemical, and electrical properties and inferior end-use characteristics.

The unique combinations of Geon 404's superior physical properties (deformation, abrasion, and cutting resistance) and electricals indicate such possible uses as weatherproof line wire, primary insulation on military field wire and aircraft wiring eliminating the need for a jacket, radio hook-up wire, television lead-in wire, and Navy cable and coaxial cable jackets.

Geon 404's chemical resistance coupled with ease of fabrication, machineability—and even weldability—introduces a Geon resin for the first time into the field of structural plastics. Sheets, rods, and tubing of various diameters can be fabricated ranging from brilliant opaque to translucent and in a wide color variety.

PLANNING YOUR FUTURE

By T. A. MARSHALL, JR.

METROPOLITAN LIFE INSURANCE COMPANY, NEW YORK, N. Y. MEMBER ASME

THE college student about to graduate must make several important decisions concerning his future. For what field of endeavor does his education and general background fit him? Where will he have the best chance of using his talents for success and personal satisfaction? What additional development or training will he need for success? Many, however, do not devote the serious attention that it should require to the selection of their field of endeavor and their employer. As a result, they wander aimlessly down the road into the future.

The insurance companies say that a young man of 25 can expect to live better than 45 more years. At a modest average annual salary of $6000 that time has a gross business value of more than $270,000. The decisions that young man makes at the start of his career involve more money than most of the decisions he will make at the height of his career.

Frequently the young graduate will accept employment, temporarily or otherwise, in fields of work, or with another employer than that of his choice. His reasons are usually economic. For instance, one young student at a well-known engineering school had majored in aeronautical wind-tunnel research. He looked forward upon his graduation to joining the National Advisory Committee for Aeronautics. Unfortunately, that year, 1932, was the beginning of several slack years in the aeronautical industry. The NACA hired no new graduates for several years. The three private companies that had wind tunnels had either already closed that phase of their research or were about to do so.

He looked for suitable employment for six months. He was not financially able to weather the storm by continued schooling so he obtained a job in the stationary-engineering division of a large financial institution operating its own buildings. From there, quite by accident, he was transferred some four years later to the planning and methods department to draft charts. He developed an interest in planning and methods work and then in management engineering. After a lapse of over four years, he commenced to plan his course. Had he properly planned as an undergraduate, he might have saved himself at least the first four years of haphazard progress.

Let us see, then, what guides we can set up to help the young graduate engineer already traveling down his road toward the future as well as the college student commencing his plans for the future.

There are four major guides. They may be found in the answers to four simple, yet difficult to answer, questions:

1 What do you want?
2 Where can you find it?
3 What do you have to offer?
4 What else do you need to get what you want?

In the answers to these four questions lie the basis for soundly planning for your future.

Contributed by the Management Division, the Education Committee, and the Junior Committee and presented at the Annual Meeting, New York, N. Y., November 26–December 1, 1950, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

WHAT DO YOU WANT?

The end result you desire must be your starting point toward successful planning. What are the goals for which you will strive? What is the relative importance to you of money, social prestige, public recognition, job satisfactions, work enjoyment, and economic security? Let's consider these factors.

Financial Goals. In establishing your financial goals, remember that money is a reward for accomplishment and not an end in itself. Large earnings are for outstanding performance. Only a limited number may achieve them.

Start a graph, plotting your financial aims year by year for about ten years ahead. Then plot actual income on the same chart. At the end of each year, re-examine and adjust your financial aims if necessary. Take into full consideration your financial needs, current trends in salaries, and the effect of fringe benefits, bonuses, and incentives.

Social Goals. Being a social animal, it is only natural, and fortunate too, that you will give considerable weight to the social advantages to be found in your job. Recognition and prestige are important too. A title can sometimes give as much personal satisfaction as a raise.

This social bent causes many of us to choose occupations that have a standing in the community, the state, or the nation. For example, in the teaching profession, in public-works administration, or in the military establishment. Some choose occupations that may result in leadership in public affairs or holding public offices, such as city manager, or an elective job in the executive or legislative branch of government. Other prefer occupations that subordinate self and possible financial gains to a deep-seated and sincere desire to benefit society. These might be in biological or medical research.

Job Satisfactions and Work Enjoyment. A person generally does his best in work he likes. He expends less effort, too. Many a man has rejected greatly increased financial benefits because the job was distasteful or did not provide job satisfaction.

Therefore, in selecting your field of future endeavor, select the one that suits your natural aptitudes and provides responsibilities that will enhance your growth.

The inner satisfaction that comes from a task well done cannot be overemphasized as an important motivation toward outstanding performance and success. It is a primary source of motivation in any creative enterprise.

Economic Security. In recent years there has been a decided increase in the emphasis on economic security. It has become a prime consideration to many in the selection of a career or job.

Donald K. David, Dean of the Graduate School of Business Administration, Harvard University, decries this overemphasis on economic security. In an article in the January, 1950, issue of the *Harvard Business Review*,[1] he points out that such overemphasis saps the individual of his freedom, his opportunities, his initiative, and his dignity. It takes away the very things that have made America great. *Real* security

[1] "The Danger of Drifting," by Donald K. David, *Harvard Business Review*, vol. 28, No. 1, January, 1950, p. 25.

"depends upon work and a high level of production," according to Dean David.

Initiative, resourcefulness, and adaptability have been our greatest assets as a nation. Don't trade these assets for a liability. Less emphasis now on security will make for more enterprise and initiative. In turn, these bring greater returns, and ultimately, greater *real* security. General Douglas MacArthur has said it this way: "There is no security on this earth. There is only opportunity."

Each of these factors must be weighed according to your desires or needs. Add a competently administered battery of aptitude, personality, and interest tests to correlate what you can do best with what you want. It is not enough to want to do something. In order to succeed you must also be mentally and physically equipped to do it.

For instance, you can't become an outstanding aviator by merely wanting to fly. The military services found out that, among other things, successful aviators needed a high order of muscular co-ordination, balance, and depth perception. Tests to measure these requirements prevented many failures, accidents, and loss of life due to square pegs trying to fit themselves into round holes.

You can save yourself much grief if you apply the same type of thinking to planning your future. If you don't like to meet people, don't go in for sales engineering. You won't become a success at it.

Therefore, take these tests before you plan your career and temper your wants accordingly. Your college or university may provide this service. If not, there are many competent private personnel testing services that your professors or your employer can recommend. Of course the ideal time to take the tests would be before starting college, but that's not always possible.

The resulting composite picture of what you want will provide the star for which you will aim. It will provide the specifications for your chosen field of endeavor. It will provide the base that, in turn, will aid in determining the additional assets you must develop or create.

WHERE CAN YOU FIND IT?

Having decided what you want, the next step in your planning is to determine where you can find those values that you want. The range of opportunities for the young graduate engineer is more varied than ever before.

It reminds me of the young college student, about to graduate, who was asked by his professor, "Now that you are reaching the end of your college course, what have you learned?" The young student replied, "The more I have learned, the less I know! It seems as though the horizon bounding the field of knowledge recedes faster than that knowledge can be obtained. The more I learn about a subject, the less I really know about it in proportion to the whole."

So it is with opportunities for the young engineer. Opportunities develop and grow into being much faster than can be realized. This is especially true for the young man with vision, initiative, and resourcefulness.

In the past, young engineers have usually found employment in the fields of creative engineering, design, research, sales, production and quality control, maintenance, plant engineering, production, and manufacturing.

In recent years, engineers have successfully moved into such fields as cost accounting, investment analysis and advice, advertising, marketing and distribution, purchasing, personnel work, human relations, and patent law.

Additional opportunities for men with engineering training can be found in the fields of business administration, journalism, economics and finance, office management, traffic planning and management, and actuarial science.

Industrial-engineering techniques and methods, involving work measurement, production control, and statistical quality control, are just beginning to be applied widely in the clerical field. There are many institutions, large, medium, and small, where the potential is tremendous for operating economies in the office through the use of industrial-engineering techniques. The application of these techniques in office work requires real ingenuity. In many cases it is far more complicated than in the usual plant applications.

For example, the problems in design and control of methods and procedures, and the scheduling and production-control problems encountered in large-scale clerical work, where two cases in sequence are seldom exactly alike, require the best talents of the industrial engineer to solve.

Thus the young engineer can find many new opportunities where his talents can be used to advantage. Some may be found in the same manufacturing and servicing industries usually chosen by engineers. Others may be found by the application of engineering talents in nonengineering industries and businesses. These would include banks and financial institutions, insurance companies, farms, department stores, mail-order houses, real estate, labor unions, and engineering and allied publications.

Particularly, think of the many opportunities that are to be found in the thousands of small plants throughout the country. There are more than 300,000 manufacturing concerns employing less than 250 persons according to Dr. A. D. H. Kaplan, economist with the Brookings Institution.[2] Many of these concerns do not employ a single engineer. For example, Dean C. J. Freund in a talk before the Administrative Council of the American Society for Engineering Education on November 8, 1948, pointed out the enormous opportunities for engineering employment existing in small plants and establishments. He stated that in Detroit alone, 3000 small manufacturing establishments employed a total of only about 48 engineers.

With a proper knowledge of what you want, selection of the proper place to apply your talents should not prove too difficult.

WHAT DO YOU HAVE TO OFFER?

The third of our four major guides involves the organization and presentation of what you have to offer your future employer or employers. What can you do that makes it to the economic advantage of your prospective employer to hire you? If any one of our four major guides may be considered to be more important than the others in determining your future success, it is this third one. Its value cannot be overestimated.

In organizing what you have to offer for presentation to prospective employers, you should study the Man Power Specifications, developed and used with considerable success by the late A. W. Rahn.[3]

These specifications consist of:

First, A résumé of the "Types of Work in Which I Would Be of Best Service." This appears on the front page of the specification. It is a definition of your work abilities. It sets forth "What I Can Do" expressed in work terms.

Second, A functional history of the past expressed also in work language. This is the "What I Have Done." It must be fully completed before a start can be made on writing the "What I Can Do" section. It includes education, travel,

[2] "Small Plant Management," McGraw-Hill Book Company, Inc., New York, N. Y., 1950, chapter 1, p. 11.

[3] "Your Work Abilities and How to Express and Apply Them Through Man Power Specifications," by A. W. Rahn, Harper and Brothers, New York, N. Y., 1938.

hobbies and interests, business experience, military record, and personal development.

A brief description of the Rahn Plan by Benjamin C. Koch, appears in the 1945 Proceedings of the Annual Conference of the National Office Management Association.[4]

Whatever method of presentation you choose, give your prospective employer an adequate picture of:

1 Your outstanding personal characteristics. Poise, initiative, tact, resourcefulness, persuasiveness, adaptability, enthusiasm.

2 Your outstanding mental characteristics. Ingenuity, creativeness, judgment, objectivity, mental maturity.

3 Your education and background. Major courses, travel, fluency in foreign languages, extracurricular activities and achievements, hobbies, interests.

4 Your professional knowledge and experience. Express in work terms the scope and importance of your business and military experience.

Employment is a two-way proposition. You need employment. Your employer also needs you. Tell him what you can do. Tell it in work terms, not in job titles. If you do this well, your prospective employer will know whether your talents and abilities will fill his needs. You will then find work that is to the mutual advantage of both you and your employer.

Many examples of the effectiveness of properly presenting what you have to offer—what you can do—can be found. Rahn gives a number of such examples from his experience in helping others find work during the depression of the thirties. His examples include a college student, a corporation vice-president, a college professor, and lawyer with three engineering degrees.

I think the classic example, however, is his story of a man who spoke little English and was classified as a moron by three psychologists. He had been on relief for two years. Relief officials considered his case hopeless. With guidance, he wrote his own Man Power Specification and within three weeks was working at $50 a week. A checkup some time later showed him still holding that position.

It is vitally important to your success that you soundly organize what you have to offer. You must do so, not only to present your potential economic utility intelligently, but also to enable you to find out what else you need in order to get what you want.

WHAT ELSE DO YOU NEED TO GET WHAT YOU WANT?

What else you need is the difference between your own inventory—what you have to offer—and the end result you desire—what you want.

Remember, you must continue to grow. You can never deliberately stand still. Either you move ahead or you fall behind. In moving up the stream of business, you can't rest on your oars without losing ground with the tide. If, for no other reason than this, it is necessary, that you continue your personal and professional development throughout your business life.

Two years ago, T. E. Shea, president of the Teletype Corporation, stressed this same point.[5] In discussing the qualifications for creative engineering, he stated: "Of all the things I know about engineering, I am most humble about the sheer inadequacy of any one man in knowing all that he should know; a lifetime of diligence in learning leaves him still woefully ignorant; . . ."

Study the characteristics of acknowledged leaders in the field you have chosen, their education and knowledge, experience, personal and mental characteristics. You will learn what others have needed to achieve success in that field. Make your plans to get these things yourself. They are some of the things you need to know most to get what you want.

In addition, apply the following rules, without appearing overzealous or becoming obnoxious; without being an "eager beaver":

1 List the various duties of your job. Set up performance standards and check your actual performance against these standards. Be thoroughly objective in your check.

2 Find out more about where your work comes from and where it goes. The understanding gained here will help you do a better job.

3 Broaden your knowledge within the company by getting to know people in other departments. Learn all you can about your company. Learn its products and services, its organization, its policies, its accomplishments.

4 Select the position in your company that you will strive for. Learn all you can about it. Find out what talents you must develop or create to fill that position.

5 Broaden your viewpoint by participating in professional and other outside organizations. Be more than just a "joiner." Work actively on committees or on special projects. You will then get the fullest benefits from your membership.

6 Broaden your general knowledge by planned reading and study. You must continue the growth you started in school by continuing your reading and study at home. Don't confine your reading to your specialty.

7 Apply what you learn to planning, organizing, and administering your own work.

8 Train yourself out of your shortcomings. Get the additional experience you may need outside your own company after hours or on week ends.

9 Train a competent successor rather than protect your job When you have done this you will be ready for promotion.

LOOKING AHEAD

Industry feels a deep responsibility for its part in planning the intelligent use of our engineering manpower potential. It spends large sums in selecting and training its young engineering employees. It also spends much in testing and placing them in positions that best suit their aptitudes, considering the economic needs of the company.

The colleges and universities have recently extended their placement efforts into the field of vocational guidance. They are taking a real interest in helping the young college graduate find his proper place in industry.

Nevertheless, with all of the testing, training, and vocational guidance, the basic decisions in developing a plan for his future must be made by the young graduate or the young engineer himself.

You must carefully plan, and carefully execute your plans for the future if you are to gain the maximum benefit from the advantages which industry and the schools place at your elbow. Your future success will be directly proportional to your success in developing the answers to the four basic questions, and in adjusting these answers periodically to meet your changing needs.

You must point toward some definite goal. You must measure your abilities against your aspirations. Then you must make up the differences by diligent work and study if you expect to attain your goal in the time available.

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[4] "The Rahn Plan—Human Engineering for the Individual and for the Enterprise," by Benjamin C. Koch, NOMA Proceedings 1945, p. 44.

[5] "An Industrial Point of View on Creative Engineering," by T. E. Shea, MECHANICAL ENGINEERING, vol. 71, no. 5, May, 1949, pp. 391–394.

BRIEFING THE RECORD

Abstracts and Comments Based on Current Periodicals and Events

Compiled and Edited by J. J. Jaklitsch, Jr.

MATERIAL for these pages is assembled from numerous sources and aims to cover a broad range of subject matter. While few quotation marks are used, passages that are directly quoted are obvious from the context, and credit to original sources is given.

Government Scientific Manpower

THE Department of Defense and the Atomic Energy Commission engage the services of about two thirds of the nation's scientists and engineers who normally do research and development work, and if the expanded program contemplated by both agencies materializes, these agencies may absorb some three fourths of the nation's technically trained personnel. This statement was made by Eric A. Walker, executive secretary of the Research and Development Board, Washington, D. C., at the annual meeting of the American Association for the Advancement of Science, held in Cleveland, Ohio. Mr. Walker spoke on the effects of government support on scientific research. He also pointed out that even on the basis of rough estimates, military research and development, including atomic-energy research and development, now accounts for nearly two thirds of the national expenditure for research and development.

The greatest portion of the creative thinking and effort of the nation's scientists and engineers is, of necessity, being concentrated on weapons devices, and techniques of warfare and countermeasures, he said. The nation is not only spending more on research and development than ever before, but most of it is going for military purposes. Obviously, this is having a profound effect on our culture. There have been diversions and disruptions in the normal fields of teaching, and academic and industrial research. Basic research has been subordinated to applied research and to development, and projects that might have been undertaken in "normal" times have never seen the light of day, Mr. Walker stated.

To see what further effects may be expected in so far as scientific and technical manpower of the nation is concerned, Mr. Walker examined the scope of this contemplated program.

For example, he pointed out, in 1940 the total national expenditure for research and development was about $350,000,000, while the military expenditures for research and development were around $22,000,000. By 1945 the national expenditure had jumped to $1.1 million, and the military expenditures—including those of the Office of Scientific Research and Development—were around $600,000,000. By 1951 one estimate places the national expenditure at $1.75 billion, while another sees it at over $2 billion. Between 1945 and 1950 the military expenditure for research and development, exclusive of atomic energy, has remained fairly constant and has been in the neighborhood of $550,000,000. The Korean War, which immediately produced requests for a supplemental budget, has also raised the research and development budget to something over $1.1 billion.

Further increases are, of course, contemplated for 1952, and, he said, there is a distinct possibility that before long we may find ourselves operating at almost double the postwar rate of military research and development.

Studies have indicated that only 15 to 20 per cent of those trained in scientific engineering, and technical fields are actively engaged in research and development work. The remainder offer a partial solution to what looms as a severe shortage of technical manpower.

Initially, we can assume that a substantial portion of the increased budget for military research and development is going to be absorbed by rising costs. Material and service costs have risen 19 per cent since 1947. The average salaries of all civil-service workers have risen 13 per cent since 1947. Probably, industrial and university salaries have risen comparably. Overtime allotments may be expected to account for as much as a ten per cent increase in the cost of the program. After taking into consideration the amounts which must be subtracted to take care of inflationary trends, let us assume that a $325,000,000 program will remain to be manned by additional scientists.

One method of estimating such requirements is to divide the $325,000,000 by the average cost per scientist, which is estimated to be about $12,000 per year. Dividing, we obtain a requirement of 27,000 additional scientists. This figure represents an expansion in military research and development technical personnel by some 50 per cent and is about 15 per cent of the total national supply of persons thus qualified. These requirements can be met if scientific and technical personnel are recruited from nonmilitary tasks such as teaching and industrial research.

Mr. Walker asked, . . . but, is this a desirable solution? We

How to Obtain Further Information on "Briefing the Record" Items

MATERIAL for this section is abstracted from: (1) technical magazines; (2) news stories and releases of manufacturers, Government agencies, and other institutions; and (3) ASME technical papers not preprinted for meetings. Abstracts of ASME preprints will be found in the "ASME Technical Digest" section.

For the texts from which the abstracts of the "Briefing the Record" section are prepared, the reader is referred to the original sources: i.e. (1) The technical magazine mentioned in the abstract, which is on file in the Engineering Societies Library, 29 West 39th St., New York 18, N. Y., and other libraries. (2) The manufacturer, Government agency, or other institution referred to in the abstract. (3) The Engineering Societies Library for ASME papers not preprinted for meetings. Only the original manuscripts of these papers are available. Photostat copies may be purchased from the Library at usual rates, 40 cents per page.

cannot raid either our industrial establishments or our schools without deleterious effects on both. A critical aspect of the over-all picture is the diminishing rate of supply of new scientists. Fewer numbers of students are enrolling in the scientific courses in the colleges.

Selective Service is another complicating factor. The absence to date of a clear-cut policy on the deferment of scientific personnel has resulted in the induction into the armed services of a number of technical personnel at various stages in their training. In addition, departmental call-ups of scientific reserve officers are cutting into civilian scientific activities. These problems are difficult ones to solve, but it is hoped that an over-all national policy will soon emerge.

The utilization of scientific and specialized personnel within the Department of Defense is yet another aspect of the matter. The Personnel Policy Board of the Department of Defense is working on a policy for the most appropriate assignment of scientists and specialists to military jobs and for their effective utilization in those jobs. If adopted, this policy will help to prevent misassignment of scientific manpower required by the Services.

The Personnel Policy Board and the military departments are working hard on an analysis of scientific and specialized jobs in the Services. This project, together with the New National Science Register which is the brought-up-to-date version of the old National Roster of Scientific and Specialized Personnel, are the first vital stages in finding out where we stand in matching people with the jobs to be done.

Obviously, there are no ready solutions to the technical manpower problem. Additional military research and development have been found necessary under the stepped-up defense program, and additional personnel to accomplish it can be obtained only at the expense of some other activity. For these various activities to compete with each other for the needed personnel would be to produce a disastrous effect upon wages, which in turn would reduce still further the actual funds available for research. Tapping the huge reservoirs of scientists and technical personnel not presently pursuing their professions brings up the question of some form of national service. This, in turn, is part of the national manpower problem, which obviously cannot be solved overnight.

Some individuals and institutions have taken the initiative to help meet the crisis, Mr. Walker said. The Engineering College Research Council and the Association of Land Grant Colleges and Universities have recently proposed to set up an association to facilitate the procurement of research and development contracts. There is a small but fairly constant volume of mail from both individuals and organizations who indicate their interest in getting into the military research and development picture.

A reliable mechanism for insuring that "buyers and sellers" are brought together in an adequate manner has not yet been worked out but the need for such a mechanism exists.

Mr. Walker also pointed out that the establishment of another OSRD is not immediately contemplated. He recalled the able job done by the OSRD in World War II, indicating that not only have the funds for research and development grown in the last ten years but so, too, have the mechanisms for the administration of those funds.

At the time the OSRD was established, the funds for military research and development were small, and the Army and the Navy had separate programs which were unrelated to each other. By the end of the war, the contract for research and development, which was used so successfully by the OSRD, had become an established pattern. Both the Army and the Navy wrote new contracts with former OSRD contractors to continue work that they had begun under OSRD. Similarly, much new work was undertaken. The Office of Naval Research carried the ball for basic research, and its university program deserves only praise. Each of the military departments has its own program of research and development being carried on both by contract and in-service laboratories. It is hoped that the Research and Development Board has contributed something to the integration of these programs and to an over-all program of military research and development. If the task of co-ordination is not yet all that it should be, at least we can feel that we have helped to bring about a fruitful cross-exchange of information. The Services are not only aware of what each other is doing, he said, they are aware of relevant work which is being done by industry and universities. This process has been labeled "co-ordination at the working level," but it really feeds the bloodstream of the research and development program.

Also in the offing is the creation of a National Science Foundation which will fill a conspicuous gap in the national picture.

Most important of all, Mr. Walker said, we have a new sense of awareness of the importance of technology to modern warfare and a mutual respect and understanding between the military and the scientists.

Rubber-Toothed Belt

LARGE-SCALE production of a rubber and fabric belt with teeth, which the United States Rubber Company has developed, has been started, according to a recent report.

Known as the Gilmer timing belt, it fulfills the need for a power drive which will not slip and permits split-second precision timing, the company said. In addition, it will attain speeds up to 16,000 fpm, and operate more quietly than precision gears running in an oil bath.

The new belt is said to have replaced flat belts, V-belts, chain drives, and gears in hundreds of applications as a more economical and efficient means of power transmission.

It can also be used as a functional part such as a synchronized conveyer as well as for transmitting power. In color television it has proved itself as the only satisfactory method of

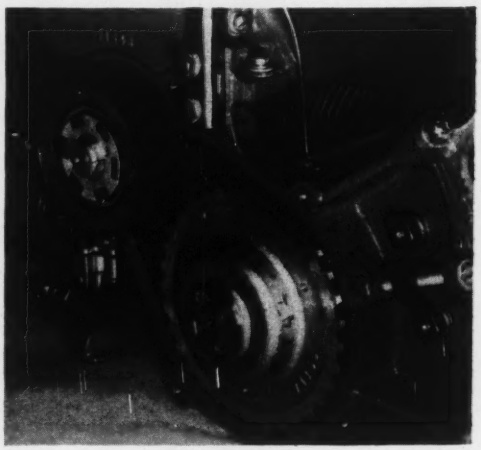

FIG. 1 NEW RUBBER BELT WITH TEETH DRIVES THIS 4-HP PORTABLE CHAIN SAW

FIG. 2 NEW RUBBER BELT WITH TEETH IS INSPECTED ON GAGE MACHINE

providing perfect synchronization between the color disk on the receiver and the color disk on the camera, reports indicate.

On commercial sewing machines it has made possible operating speeds which are 50 per cent faster than those possible with other drive mechanisms with net increases in production of as much as 25 per cent.

In floor polishers, sanders, saws, and other portable tools, it has replaced flat belts, V-belts, and chain drives with a sizable reduction in costs, elimination of lubrication problems, and higher operating speeds.

Other successful applications for the belt include electric typewriters, high-speed pumps, automatic screw machines, gasoline pumps, ditto and card-stacking machines, U. S. Navy Sonar equipment, and in atomic research on a neutron speed selector where it has operated at speeds as high as 16,000 fpm.

It can also be used to achieve greater uniformity in the productive rate of industrial machinery. This is important in piecework operations where there is a loss of production due to belt slippage in otherwise identical machines

Perfected after 12 years of research by the L. H. Gilmer division of United States Rubber Company, the belt is similar in appearance to a flat belt except that it has regularly spaced rubber teeth along its inner surface which engage in corresponding grooves in the pulleys. It can be manufactured in any desired size and in a variety of materials to suit specific applications.

The belt is now in production in the L. H. Gilmer plant at Philadelphia, Pa., and it will be marketed initially through the L. H. Gilmer division.

Current production is limited to specifically engineered applications. However, the company expects to offer a standardized line of stock drives in both heavy-duty and light-duty constructions with a sufficient number of pulleys to give an adequate range of speed ratios.

In addition to its antislip characteristic and precision timing, the new belt will not stretch. It will operate on fixed centers without take-up adjustments. Since it needs no initial tension it has unusually high efficiency with extremely low bearing pressure. Tests have shown that the belt operates more quietly than precision gears running in an oil bath.

The belt requires no lubrication. However, oil will not harm it. It is unusually compact and speed ratios up to 30:1 are possible with it. The belt's extreme flexibility permits pulley diameters as small as one-half inch at 10,000 rpm even with a heavy load.

Maintenance costs are low because of the absence of take-up mechanisms, elimination of lubrication, and elimination of power waste. Moreover, the initial cost of the belt may be lower than other types of drives because of smaller drive constructions.

Giant Lift Truck

AN 80,000-lb-capacity industrial lift truck, said to be the largest of its kind, has been completed by The Yale & Towne Manufacturing Company, Philadelphia, Pa. Built for the steel industry, this giant truck is designed to reduce handling time, and increase both output and quality of cold-rolled strip steel now in critical supply.

The truck weighs 84,000 lb and is 178 in. high, 124 in. wide, and can turn in a radius of 168 in. (14-ft aisle). Its lifting height is 91 in. The power unit consists of a 165-hp Cummins Diesel engine driving a 90-kw General-Electric locomotive-type generator. On the front of the truck are two huge snoutlike rams that open and close like scissors. These unique rams provide, for the first time, a unit that can carry one large coil of steel or two smaller ones. It is the first of a new series of ram and fork trucks now available in capacities from 20,000 lb to 100,000 lb.

According to a Yale spokesman, the need for this equipment arose after the recent introduction of continuous wide strip mills which roll coils of steel at speeds of more than 5000 fpm. These mills have been found to be capable of rolling faster than material could hitherto be supplied or carried away. This truck, which will now permit the increase of coil sizes from

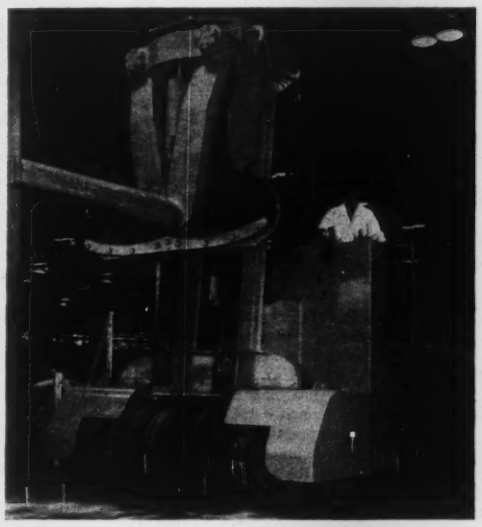

FIG. 3 NEW 80,000-LB-CAPACITY LIFT TRUCK FOR HANDLING INCREASED SIZES OF COLD-ROLLED STRIP STEEL

today's normal 30,000 or 40,000-lb coils, to 60,000 or even 80,000-lb coils will help solve the difficulty.

At the present time 17 per cent of the entire rolling time for coils is often consumed in handling, according to operation statistics from one large steel producer. It was also pointed out that by doubling the size of the coils handled, steel mills will not only cut handling time per pound of steel, but also improve the quality and yield per coil, since the ends of coils rolled while the strip mill is accelerating and decelerating are for the most part "off-gage" and rejected.

Other new engineering features of the Yale ram truck are the dual controls and narrow construction of the lifting channels which provide the utmost visibility for the operator. Also, despite the fact that the loaded weight of the truck will exceed 150,000 lb, only a fingertip touch on the steering handle is necessary to actuate the hydraulic system that turns the wheels.

Of particular interest to steel mills and other plants where floors are likely to be uneven is the fully articulated construction of the drive (front) and trailing (steering) wheels which permits equal wheel loading despite bumps or declivities.

Britain's Industrial Economy

SPEAKING before the Industrial Instruments and Regulators Division luncheon during the 1950 ASME Annual Meeting, on the industrial economy of Great Britain, W. R. Woolrich recalled that World War I did much to weaken the Empire's controls between Britain and her colonies and dominions when the monetary center of the world moved from London to New York. Mr. Woolrich is a member of ASME and Dean of Engineering, University of Texas, Austin, Texas. The British Navy, he said, the revered emblem of every colony's safety on the high seas, suffered some heavy losses, and the dominions and colonies, by furnishing essential equipment and goods for allied defense, became more conscious of their own capacity to produce.

World War II accentuated these economic changes by giving more recognition to New York as the world financial center, by greater inroads of attrition on the British Navy, and by a general awakening of the colonies and other dependencies to their own vast production possibilities and capacities. And incidentally, he said, the Point 4 program, inaugurated by the United States for peoples needing technical assistance, presented the many political leaders of Britain, Holland, France, and Belgium with visions of one more spear that might aid in severing the ties essential to the colonial system.

INTERNAL CONTROLS

The two internal controls that best safeguard Britain's established industry are the trade associations and the British Board of Trade. Major purchases of raw materials not produced in the British Isles are made by the Board of Trade. The Board in turn rations and sells these materials to the manufacturers as it deems advisable. The Board of Trade is a government-controlled enterprise, established in 1786, and is one of the powerful control agencies directed under the Lord President of the Privy Council.

Trade-association practices vary widely, he pointed out, but it is quite a common practice of the older associations to dictate who shall and shall not be admitted into their specific manufacturing field.

Price setting for the sale of finished materials is not uncommon in a given manufacturing field, and the prices are often determined by the producer having the highest unit cost. This has the effect of perpetuating inefficiency. There is no great urge to install new efficient equipment if the product of the old machines can be sold at a profit. This type of price control is probably one of the principal factors in keeping the man-hour costs of some manufactured goods higher than within the United States.

In some of the newer industries such as heat-control-equipment manufacturing—where little trade-association regulation is experienced—the efficiency of manufacturing closely approximates that of the United States.

Dean Woolrich emphasized that trade-association control is not a new feature in British production. The same type of trade-association control that the U. S. experienced during the NRA days has been legal and practiced for half a century. It has been recognized (by each of the principal political parties) as a proper function of the trade associations to regulate their business. Trade-association activities are well supported by the British Government, and quite generally trade-association research activities receive a 50 per cent subsidy from the Government.

RELATIVE PRODUCTIVITY OF BRITAIN AND THE U. S.

W. C. Puckey, in a paper presented at a joint meeting of the Institution of Production Engineers and the Institute of Costs and Works Accountants in November, 1948, stated, "The average productivity of an employee in American manufacturing industry was represented 2.2 as compared with 1 for a corresponding individual in Great Britain." Critical listeners were reported to have challenged his figures, but the publications of the National Institute of Economic and Social Research, London, especially those by L. Rostas on "Comparative Productivity in British and American Industry," (Cambridge University Press, 1948), lend much support to Mr. Puckey's figures. The following sample was cited by Dean Woolrich:

OUTPUT PER MAN-DAY

	Agriculture	Manufacturing	Mining	Building
U. K.	1.0	1.5	0.7	2.0
U. S.	1.0	3.2	2.9	2.6

	Public utilities	Transportation	Finance	Government	Distribution
U. K.	2.6	3.9	5.7	1.5	1.9
U. S.	6.0	3.9	5.7	2.6	2.8

Besides those mentioned, there are other factors that affect the manufacturing productivity of Great Britain. The fact that many American-owned industries are manufacturing similar goods with similar equipment on each side of the Atlantic, with considerable disparity in labor output in favor of the American worker causes productivity investigators to search further for the answer.

Factors that are being given serious consideration and searching study by the British in order to meet American competition are: (*a*) The horsepower of energy used per worker, (*b*) the degree of standardization, (*c*) equipment conditions, (*d*) working conditions, (*e*) managerial skill, and (*f*) worker psychology.

Energy per Worker. In the report of 1939 the ratios of power used per worker in significant industries were as follows between Great Britain and the U. S.: Iron foundries, 1 to 3.2; machinery, 1 to 2; cement, 1 to 3.4; cotton spinning and weaving, 1 to 1.4; motorcars, 1 to 4.7; and grain milling, 1 to 3.3.

Degree of Standardization. There is no tabulated measure of the relative advance of the two nations in standardization, but a spot sample of the report made by the U. S. Bureau of Standards in 1937 that "varieties and shapes have been reduced by

manufacturers in the production of fruit cans from 200 to 21, blankets from 78 to 11, common brick from 75 to 2, steel sheet from 1630 to 209, milk bottles from 49 to 4, and institutional cotton textiles from 1630 to 209," are still a hopeful dream in the British Isles. The postwar experiences in Great Britain in the production of utility men's suits and women's dresses, underwear, and shoes was a drastic step in style simplification and it enabled the manufacturers to sell medium-grade clothing at a much reduced cost.

Equipment Conditions. On equipment conditions no current reliable report is available. In those industries that are protected by trade-association price, no doubt poor equipment can be blamed in part for low production. But in manufacturing, such as that of boots and shoes, comparable equipment is employed in both countries.

Most of those who discuss freely Britain's lower productivity and who are well informed on the equipment in the more modern British plants agree that the problem of boosting British production is not so much a matter of comparable equipment as it is that of "the human factors in works management."

Working Conditions. While climatic conditions of Great Britain are conducive to satisfactory inside working temperatures, many of the other factors that affect efficient and effective production are below the American standard, Dean Woolrich stated. A large portion of the older British plants are poorly lighted, and with their short winter days highly effective artificial lighting is more necessary than in the more southerly American plants. During the postwar period the British Electrical Authority has seen fit to require many of the manufacturing areas to reduce their lighting load by one half. Only the workers with excellent eyesight could possibly maintain high productivity in the evening work hours under the lighting available in many of Britain's plants since World War II.

Floor designs for production are generally below our standard for material handling and movement. Many of the old leased properties are not well-suited to the type of manufacturing for which they are used.

Plumbing facilities have for generations been trailing those of the United States, and whether it is in the home, hostel, or the factory, plumbing arrangements and equipment leave much to be desired.

Managerial Skill. In the period of American production from 1900 to 1910, a large majority of ASME officers adversely criticized the fine leadership in management of such men as James Hartness and L. P. Alford, Dean Woolrich said. They emphasized that management theory and principles had no place in an engineering society.

Supporters of this same philosophy can be found in the engineering profession of Great Britain today. American practice in teaching the principles of management in universities is fully a quarter of a century ahead of that of Great Britain.

As of 1948–1949, the first graduate work in management was offered by a British university at the University of Birmingham. A number of the technical colleges, the equivalent of our technical institutes, have promoted lecture courses in management principles, but as a university subject industrial management is just becoming recognized.

Worker Psychology. Worker psychology must be changed in the British industries if they are to appreciably increase the man-hour productivity. Piece work and bonus rates have never taken their place in British production as in North American. Furthermore, the concerted action displayed by workers from time to time against the introduction of laborsaving devices is disturbing.

Civil Defense

IN September, 1950, the National Security Resources Board published "United States Civil Defense" (MECHANICAL ENGINEERING, December, 1950, page 992) which presented recommendations for the national civil-defense program, including a summary of functional responsibilities for civil defense health services and special weapons defense. A new volume, "Health Services and Special Weapons Defense," has now been prepared for the Federal Civil Defense Administration by the Health Resources Office of the National Security Resources Board. This volume elaborates on those responsibilities and sets forth a program for the development of state and local civil-defense health services.

The health services, to be most effective, must be fully coordinated with other civil-defense services. Without adequate fire-fighting or rescue service, for example, many lives that could be saved would be lost because first-aid and surgical services could not reach the injured. Without excellent coordination between the health services and the transportation service, sufficient transport would not be available for movement of personnel, casualties, and supplies. Without emergency water and electricity provided by the engineering services, hospitals would be crippled. Without the radiological services provided by the health service, fire, police, rescue, and other services could not function safely. These few illustrations of interdependence point out the necessity of co-operation between services and of adequate knowledge by each service of the organization, functions, and responsibilities of the others.

Serious difficulties in planning for civil-defense health services, not necessarily common to all civil-defense services, are the potential severe shortages of professional personnel, special facilities, and supplies.

Shortages of certain types of professonal personnel and of health facilities are acute even during peacetime. Personnel shortages would become drastic immediately war began because of the need for civilians to share professional personnel with the Armed Forces.

Plans for health services in civil defense must be made on the assumption that no help from military personnel, equipment, or supplies would be available for civilian wartime disaster relief. It is possible, that, at the time of a civilian disaster, military help could be provided without endangering military operations. Such possible assistance should, however, be regarded as an unlikely potential reinforcement, not as a substitute for civilian efforts. Thorough planning for civil-defense health services to make the maximum use of personnel and supplies, therefore, is necessary.

This volume outlines the functions, responsibility, and organization of the civil-defense health services. Topics covered include: Special weapons, defense problems, health services in civil defense, first-aid and ambulance services, civil-defense hospital services, health supplies, water, sanitation, nutrition, laboratory and industrial health services, radiological defense, and biological and chemical-warfare defense.

The material in the book presents functional needs, rather than an administrative blueprint. The experience of the Resources Board, in co-operation with three metropolitan areas in "pilot study" projects, shows clearly that when methods of meeting functional needs are determined, the overall organization and administration follow naturally. If a contrary course were taken, functions would have to be fitted in to match the blueprint. The ultimate result might be a confused picture of split, overlapping, or neglected services. For this reason, each state and municipality is urged to start its health service planning on a functional basis. A considera-

ble degree of nation-wide uniformity in federal, state, and local civil defense administration, however, is necessary. Therefore, where the local structure permits, the recommendations on administration and organization made in the booklet should be followed.

Critical target areas should start immediately to put these recommendations into effect. The first stages should be directed toward making best use of resources immediately available. Communities not in critical target areas should be guided by their state and local civil-defense authorities in organizing units for mutual aid and mobile support.

The 260-page booklet is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at 60 cents per copy.

Corrosion Testing

WITH the formal opening, late in 1950, of Harbor Island Station at Wrightsville Beach near Wilmington, N. C., new corrosion-testing facilities have been added to the Kure Beach Project. This sea-water corrosion-testing station at Kure Beach was established by The International Nickel Company in 1935 for the immediate purpose of comparing the corrosion resistance of low-alloy steels with carbon steel. Soon other materials were added to the program so that eventually comparative tests were being made on all kinds of ferrous and nonferrous metals and alloys. The testing facilities have since been further extended to observe the behavior of several kinds of protective coatings—both metallic and organic—including antifouling formulations, the effects of marine growth on wood as well as on metals, and even the results of exposure to sea spray and sea air upon rope.

In 1940, facilities for exposing specimens to atmospheric attack were added.

Many of the specimens exposed here and in the sea-water testing station by over 100 companies represent special materials, requiring special processing.

The number of specimens now exposed in sea water is more than 2500 and during the past 15 years the number of specimens so tested has been over 15,000.

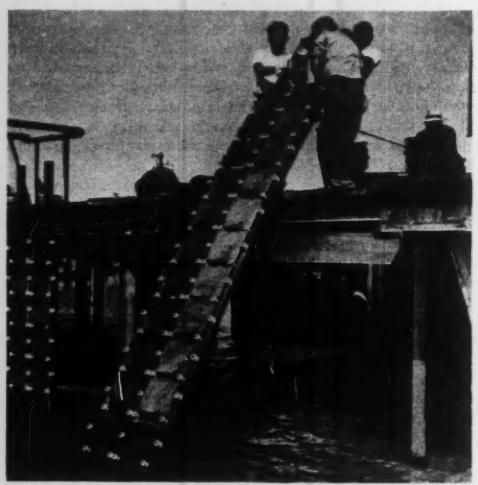

FIG. 4 LOWERING PILING TEST SPECIMENS INTO PLACE

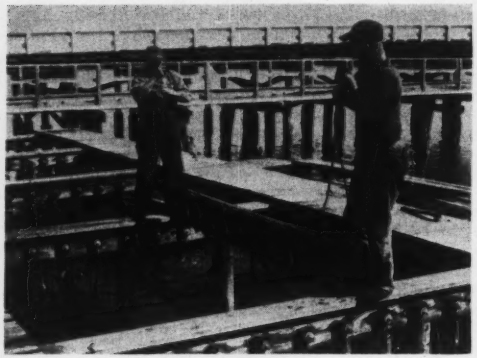

FIG. 5 MONEL RACK WITH SPECIMENS SHOWING MARINE GROWTH

The sea-water tests originally were located in a channel through which sea water was pumped from the ocean into the bromine plant of the Ethyl-Dow Chemical Company. The closing down of this plant in 1945 made it possible to remove the structure to the basin formerly used as the intake for the pumps that supplied the water for the plant.

After operating in the basin and pump house at Kure Beach for about 4 years, storm damage to the jetties through which sea water entered the basin made it necessary to abandon this site and to provide new facilities for carrying on the underwater tests at Harbor Island—located between the mainland and Wrightsville Beach, about 15 miles north of the Kure Beach site. Here, the inlet, through which sea water flows back and forth with the changes in the tides, forms an even better "Ocean Test Tube" than the basin at Kure Beach. Among the advantages provided at the new test site are the following:

1 A continuous supply of full-strength sea water, uncontaminated by industrial wastes, oil films, or other pollution that interferes with tests in harbors or near big cities.

2 A relatively wide range of sea-water temperature (45 to 85 F).

3 A long season of growth of a large number of marine organisms (of particular value in studying antifouling alloys and coatings).

4 Protection against the physically destructive effects of storms and high waves.

5 A fluctuation in water level with the rise and fall of the tides which permits observation of water line and intermittent immersion effects when desired.

6 Adequate protection to prevent the theft of or tampering with specimens.

7 The availability of personnel and mechanical equipment needed to erect the testing equipment, keep it in repair, and handle the heavy racks of test specimens.

Comparative tests at Kure Beach and in synthetic sea water in the laboratory have shown definitely that the laboratory conditions are quite inadequate for measuring the behavior of metals and alloys.

In the sea-water tests, most specimens are exposed on racks continuously immersed at a depth of from 3 to 4 ft.

Facilities have been provided also for hanging specimens from a large pontoon float when it is necessary to maintain a constant

water line or a constant depth of immersion in spite of the rise and fall of the water with the tides.

The study of the antifouling characteristics of metals, alloys, plastics, and protective coatings has been an important phase of research during the past few years.

Specimens are fastened to a monel rack by means of monel machine screws. Galvanic effects are prevented by the use of bakelite insulating tubes over the bolt shanks and insulating washers between the specimens and the racks and the monel washers under the bolt heads.

The period of exposure of a group of specimens may vary from 6 months (rarely less) to several years—the longest to date—12 years. The number of specimens exposed varies from about 1000 to 2000, depending on the nature of investigations in progress.

Since corrosion by marine atmospheres is equal in importance to corrosion by salt water, facilities have been provided for extensive atmospheric corrosion tests. Over 20,000 specimens have been exposed by Inco and co-operating companies. This lot is located at Kure Beach about 250 yards from the ocean shore. The racks face south and the specimen frames are set at a slope of 30 deg from the horizontal.

Effects of atmospheric corrosion are measured by visual observation and by determinations of weight loss, changes in mechanical properties, or both.

New specimens of certain key materials are put on the racks each time a large group is removed, or a new group is installed. These key specimens provide information on changes in the corrosivity of the atmosphere itself from year to year which assists in the interpretation of the results of tests made over different time periods.

One large group of about 1500 specimens of different steels was distributed over the racks at random so as to discover any possible effects of rack position on the results obtained. So far, no such effect of position has been observed.

Another important study combining sea-water spray as well as sea air is being carried out on a site about 80 ft from the shore, where a stand about 8 ft high and, roughly, 100 ft long × 15 ft wide has been erected. This stand supports both Monel and wooden racks, some vertical and others at the same 30-deg angle used for the atmospheric tests. There are about 2000 samples of materials under examination, including springs typical of those used for railroad cars.

The close proximity of these racks to the surf breaking on the adjacent beach makes the corrosive conditions very severe. Some steels are corroded ten times faster here than in the main test lot further from the ocean.

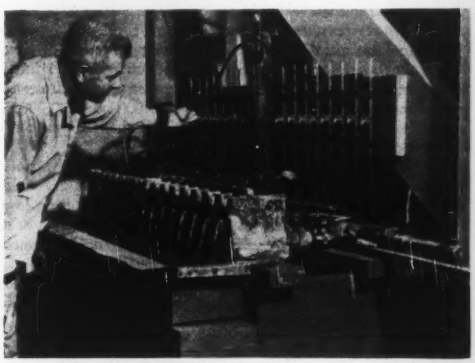

FIG. 6 ASPIRATOR OF JET TESTING APPARATUS SUBJECTS TEST SPECIMENS TO THE EROSIVE EFFECTS OF HIGH-VELOCITY JETS OF SEA WATER MIXED WITH AIR BUBBLES

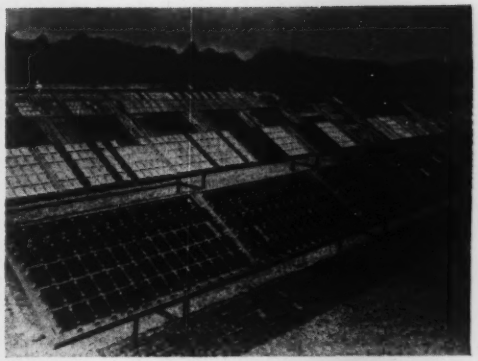

FIG. 7 GENERAL VIEW OF ATMOSPHERIC TEST LOT

The new laboratory at Harbor Island offers improved means for preparing specimens for test and examining them afterward. The laboratory also includes a marine museum where sample specimens from the many studies are displayed.

Facilities have been provided for the machining of test pieces and the repair of equipment and apparatus. In addition, there is a darkroom for processing the large amount of film consumed in providing a photographic record of the many tests and test specimens that are handled each year.

Anniversary

COMMEMORATING its 125th year of unbroken publication, the January, 1951, anniversary issue of the *Journal of The Franklin Institute*, contains a symposium "Science and Tomorrow," which is intended to predict future developments in science and technology based upon the considered opinions of today's leading authorities. Contributors include Dr. Otto Struve on astronomy; Dr. Harold C. Urey, chemistry; Dr. Marston Morse, mathematics; Dr. I. I. Rabi, physics; Dr. Jerome Hunsaker, aeronautics; Dr. O. E. Buckley, communications; Dr. Norbert Wiener, controlled mechanisms; Dr. V. K. Zworykin, electronics; Dr. Wallace R. Brode, materials; Dr. Henry C. Sherman, nutrition; Dr. E. U. Condon, standardization; Dr. Charles F. Kettering, transportation; Dr. W. F. G. Swann, cosmic rays; and Dr. Frederick Seitz on solid-state physics.

Published since 1826 by The Franklin Institute in Philadelphia, Pa., writes Thomas Coulson of the Institute, the *Journal* has remained as an appropriate vehicle for the publication of articles which have a wide range of application, especially in the nature of mathematical methods. While the subjects treated are likely to appeal to specialists in several fields, the articles are unlikely to meet with a welcome in any periodical devoted to limited fields of study. The *Journal*, therefore, retains the character with which it first started, "to diffuse information on every subject connected with useful arts." The principal difference between the earliest and the latest issues is visible in the outlook of the contributors. In the beginning that which was published was in the nature of a record of what had already been accomplished. The readers were learners.

Today, he states, contributors keep a lively eye on the future and their work is frequently of the nature that foreshadows ultimate development. They seem to be aware that the future does not lie in other hands but in ours, to make of it what we can, and to shape it as we may.

Human Engineering

DURING World War II, many experimental programs were launched to find out just what human capacities are and how new devices can best be designed to fit them. The results of these programs and others are combined into a "Handbook of Human Engineering Data for Design Engineers," and is available through the Institute of Applied Experimental Psychology of Tufts College, which prepared the book for the Office of Naval Research.

The new Handbook, as reviewed in the January, 1951, issue of the *Industrial Bulletin* of Arthur D. Little, Inc., gives a wealth of data on such influential factors as body size, vision, hearing, and the effects of motion, incentives, fatigue, temperature and humidity, and stimulants. Besides well-defined data, the book includes general discussions of such subjects as vision, hearing, and intelligence, as well as extensive bibliographies and some solutions to past design problems.

Although many of the problems arose from military needs, much of the information can be applied to industrial situations, the *Bulletin* states. Indeed, this "human-engineering" approach is an extension of the long-established industrial-engineering studies of time and motion sequences in machine operations. For example, measurements of Air Force personnel, used to determine the most comfortable and efficient placement of foot pedals, might well be valuable to automobile manufacturers, or to those installing foot-operated machinery. Many measurements showed that an angle of 110 deg at the knee, with the pedal 7 in. below the seat level, is the most comfortable.

It was also found that red light allows the eye to adapt to the dark much more quickly than white or others. Navy personnel wearing red goggles for dark adaptation avoided having to stay in a darkened room before going on watch. It takes about 30 min for the light-adapted eye to increase in sensitivity 15,000 times to become fully dark-adapted, but only 2 min when red goggles are worn for 45 min beforehand. Similarly, red light for automobile instrument panels would make less demand on the driver as he shifted his gaze from the instruments to the road ahead than the common green lighting.

Although a vast fund of knowledge has been accumulated by illumination engineers over the years, the Handbook points out that the proper intensity of illumination is only one aspect of the problem. Also important are the colors in the light, degree of diffusion, colors of objects in the surroundings, glare and shadows, contrast, and the ratio of brightness of the work area to its surroundings.

Other vision tests revealed that the driver of a car can perceive unexpected objects only about half as far away as expected ones. Although the perception distance increases rapidly for the first few thousand candlepower in the headlights, it increases more slowly thereafter; the driver of a car traveling at 50 mph with 20,000 candlepower headlights sees ahead about 75 ft less than the distance required for stopping.

Another series of tests showed that glare significantly increases muscular tension, sometimes as much as 30 per cent. Although visual tasks may be carried on under severe handicaps with no immediate loss in accuracy, over a long period of time a decrease in efficiency accompanies nervous muscular tension. The energy required to type under the noise conditions usually encountered in a busy office has been measured by basal metabolism tests. When plaster walls were left bare to reflect noise, the typists showed a metabolic rate 71 per cent above the resting level; when the walls were covered with a sound-deadening material to absorb about half the noise, the metabolic rate was only 52 per cent above the resting level, and there was a 43 per cent increase in typing speed. In an experiment in a weaving room, the workers' speed increased about 12 per cent when they were wearing ear protectors. There is some evidence that even after years of work in noisy surroundings, workers do not become completely adapted to the noise, but have to adjust themselves daily.

Much of the data in the Handbook, the *Bulletin* points out, concerns the effect of physical variations in the environment on work performance. Many industrial situations involve environmental problems of heat, humidity, or noxious gases. It was found, for instance, that, within the temperature limits which bring on stupor, lowered performance was due more to boredom or lack of incentive than to the physical conditions. Fatigue or broken sleep reduces performance in some tests, but has surprisingly little effect in others. Also covered in the Handbook are a variety of subjects not usually connected directly with production, such as readability of type (Garamond, the type used in MECHANICAL ENGINEERING, can be read most quickly, but readers like Cheltenham best); and the physiological effects of tobacco, alcohol, caffeine, and benzedrine.

Atomic Power

POWER produced from atomic energy will probably be very expensive, compared with with that from present sources, according to Dr. C. G. Suits, vice-president of the General Electric Company, in charge of research.

Speaking before the annual meeting of the American Association for the Advancement of Science in Cleveland, Ohio, he said that two military factors now make it important to develop atomic reactors for producing power.

First, atomic energy is an extremely concentrated source which presents important military advantages in a mobile power plant, such as that of a submarine. Also, atomic plants may simultaneously produce large blocks of power and also fissionable material needed for military purposes in atomic weapons.

However, he said, the scientific and engineering knowledge gained from intensive effort in developing atomic power for these military reasons may, in the longer term, make possible building economical plants primarily for production of power.

Dr. Suits estimated that a plant producing about 1 million kw of heat from atomic sources, built under present limitations of technology, might cost from $50,000,000 to $100,000,000. Such a boiler plant would provide enough heat to yield 400,000 kw of electricity.

He said that it is evident from a scrutiny of the materials of construction now available and from the factors of safety which he must employ that we are paying a high price for the elementary state of our knowledge of reactor technology. A substantial factor of improvement must be expected from continuing research and development in this area.

Dr. Suits discussed the economics of several hypothetical atomic power plants. One considered atomic fuels and plant operation expenses about the same as with present plants. On this assumption, a nuclear boiler producing 1,150,000 kw of heat, would not compete with conventional fuels unless it could be built for a maximum cost of $11,100,000.

The most favorable case, however, is that where breeding of new nuclear fuel is accomplished while the original fuel is

burned, he said. With a credit for such new fuels of 2 mils for every kwhr of power produced, a total cost of $65,500,000 for the boiler, and the associated equipment required for breeding, might be economically justified.

CHEMICAL PROCESSING PROBLEMS VITAL

In another paper presented at the AAAS meeting, Dr. John F. Flagg, of the Knolls Atomic Power Laboratory in Schenectady, N. Y., said that problems of chemical processing, rather than more usual electrical and mechanical-engineering factors connected with operation of power plants, may be vital in determining whether useful power may be economically produced from atomic energy.

He pointed out that a long-term goal in nuclear power production, particularly important for possible peacetime uses, is what is known as "breeding" of nuclear fuel. That is, in the reactor where the chain reaction of uranium and similar fissionable materials are employed to give up some of their energy, it is theoretically possible to generate more fuel than is burned.

It is believed that this might be accomplished by a process in which the chain reaction in one kind of uranium (U-235) present in the fuel converts some of the remainder (which is 140 times as plentiful) to another atomic fuel. An alternative, Dr. Flagg said, is the conversion of thorium, another element, into still a third kind of uranium (U-233), which is capable of undergoing the energy-releasing process of fission.

Successful breeding, Dr. Flagg noted, would make it possible to utilize practically all the uranium, as well as thorium. In order to get out the new fuel that is produced by the process a necessary adjunct to an atomic power plant will be an elaborate chemical plant.

Illustrating the complexity of the problem, he pointed out that in an atomic reactor of the type now most commonly employed, some 34 chemical elements from zinc to europium are produced by splitting of the U-235 atoms. In addition, there are neptunium, plutonium, americium, and curium produced by a transmutation or conversion process from the more common kind of uranium.

The amounts of these materials, from which the new fuel produced by breeding would have to be separated, range from about a millionth of an ounce to perhaps a fifth of an ounce, for every ton of uranium used in the reactor, Dr. Flagg said. The problem is further complicated by the fact that most of these elements are highly radioactive and can be handled only by remote control from behind thick protective walls.

Still another factor that must be considered is the effect of the radiation from these materials on the chemicals used in the process, Dr. Flagg said. Even water, he said, will be decomposed by this radiation, giving rise to gaseous products whose presence must be considered in designing the process equipment.

ROLE OF MILITARY DEVELOPMENTS IN ATOMIC POWER

Dr. Miles C. Leverett, technical director of the NEPA project, Oak Ridge, Tenn., speaking on "The Role of Military Developments in the Field of Atomic Power," also before the AAAS meeting, said that perhaps the most outstanding characteristic of the field of atomic-energy development at present is the fact that it is motivated almost entirely by military objectives. Only military incentives are strong enough at present to provide the driving force necessary and the support requisite to carrying out a major development program for the utilization of the energy from fission.

For example, he said, it is well known that the reactors which produce plutonium at Hanford operate at a relatively low temperature, so low in fact that there is no reasonable possibility of getting power from them. The reasons for this are technologic; no high-temperature reactor was feasible when they were built. However, reactors to operate at higher temperatures are clearly necessary for power and also for any propulsive application. Whether one wants a reactor to drive a steam turbine in a naval vessel or to drive a steam turbine in an electric power plant, the temperature must be high enough to make steam in reasonably efficient fashion, and the technical development work through which one goes in achieving such a reactor is much the same regardless of whether the development is for the ship or for the stationary power plant. As another example, in a commercial atomic power plant it will be desirable to keep to a reasonably low value the amount of fissionable material invested because of the scarcity and cost of the fuel. This is also desirable in power plants for military purposes since not only is there an element of first cost involved, but also the risk of loss of fissionable material in such a power plant must be considered. In either case the power-plant designer strives to extract the maximum amount of power from the minimum investment of fuel, i.e., power-producing reactors will be high neutron flux reactors. This brings into existence some relatively new technical problems, since it means that the materials within the reactor are exposed to a high intensity of radiation and bombardment by nuclear particles. The development of materials to withstand such high fluxes is therefore a problem common to both military and peaceful motivated reactor developments. The materials-testing reactor, being constructed for the Atomic Energy Commission at Arco, Idaho, is designed expressly to make possible the carrying out of tests of materials in high fluxes of pile radiations. It will therefore be useful both to peaceful and military reactor developments.

One of the problems which faced the engineers and physicists working on the Farrington Daniels power pile at Oak Ridge was that of finding suitable materials for service at high temperatures and high neutron fluxes. Subsequent work by an entirely different group on nuclear propulsion for aircraft has resulted in the development of materials which with little modification would be useful in an application such as the Daniels power pile. Thus one type of peacetime power producer has been made easier by efforts to develop a military type of reactor, in this case for aircraft.

Not only have new materials been made available to industry, but also new techniques. The gaseous-diffusion process used in the separation of U-235 from the other naturally occurring isotopes is an outstanding example of this. New types of pumps, seals, bearings, valves, etc. are also under development, and will be useful in many industries. One may generalize the situation, he stated, by saying that the developments necessary for peaceful utilization of nuclear fission and for military utilization of nuclear fission are essentially the same up to a point rather close to the ultimate use. From a broad technologic point of view, therefore, it probably makes little difference whether the program is motivated by military or commercial considerations since the technologic problems which will be solved will be essentially the same in both cases.

Dr. Leverett indicated that the development of atomic power for peaceful use could conceivably take place in either of two sorts of programs:

1 Research and development programs motivated by the desire to develop certain materials or techniques more or less without regard to whether any useful end application can at the moment be clearly seen. This may be called "technique motivation."

2 Research and development programs motivated by the desire to accomplish some particular useful end object, such as power generation at low cost. This may be called "application motivation."

A technique-motivated program is likely to be scientifically interesting and intellectually pleasant, but is likely to spend much money without producing anything directly useful in return. An application-motivated program, on the other hand, will produce a useful end object, and will often produce new and useful techniques as well, although it tends as a matter of expediency to use existing knowledge and techniques where possible. A well-balanced program will contain both technique-motivated and application-motivated groups. Dr. Leverett pointed out that technique motivation is usual in academic institutions and in such places as the national laboratories, whereas application motivation is more common in industrial and military work. Thus the role of the military will more nearly parallel that of industry than those of academic institutions and national laboratories.

For the future, he said, or at least for the next few years, it seems that there is little possibility of any substantial change from the present dominance of military motives in the atomic-energy program. This does not necessarily set back the time when nuclear energy may be used for peaceful purposes but may, in fact, bring it nearer since the peaceful uses of atomic energy are not wanted with sufficient urgency, at least in this country, to warrant the expense of solving the technologic problems necessary to make them possible. This does not mean that there should not be a small but highly significant effort made by certain groups of scientists and engineers in the atomic program to map out the proper directions of development for given types of peaceful utilization of atomic energy. Only in this way can full nonmilitary use be made of the developments which arise from military programs.

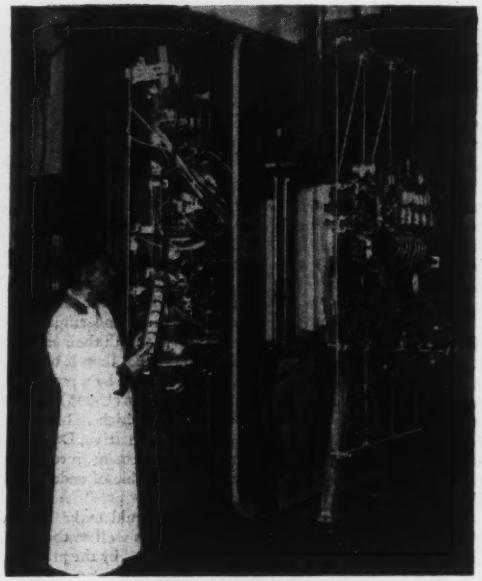

FIG. 9 RESEARCH APPARATUS PREVIOUSLY TESTED BY "DRY RUNS" IS MOVED INTO A HOT CELL FOR AN EXPERIMENT AT BROOKHAVEN'S HOT LAB

Hot Lab

THE new Hot Lab building, headquarters for processing "hot" materials, or radioisotopes, emerging from the Brookhaven pile, or reactor, after bombardment by neutrons, has been completed at Brookhaven National Laboratory, Upton, N. Y. The Lab is equipped to separate and analyze these radioisotopes, and staff members already are using the new facilities for advanced study of methods of concentrating radioactive wastes, metallurgy problems in reactor development, and other aspects of chemistry and engineering in the atomic-energy field.

FIG. 8 ACTUAL VIEW TAKEN THROUGH THE PERISCOPE SHOWING A VESSEL FILLED WITH A SOLUTION CONTAINING URANIUM, PART OF AN EXPERIMENT INSIDE A HOT CELL IN BROOKHAVEN'S NEW HOT LAB

In a room which might be thought of as a "prison block" of three cells for "imprisoning" the hottest of such pile products, 11-ton steel doors, operated by the flip of a switch, slide silently open and closed. Each pair of doors encloses a stainless-steel cell backed up by concrete walls 3 ft thick. Each door is 1 ft thick, $3\frac{1}{2}$ ft wide, and 11 ft high, and will close in 5 sec and stop automatically at the correct spot. An experiment with highly radioactive chemicals can be sealed off inside one of these hot cells and operated remotely by controls outside the doors, while the researcher observes the experiment through periscopes. Equipment is preassembled on a panel which is then fitted into the doors, and later removed for decontamination in special "cleanup rooms" nearby. Thus lost time in the hot cell is held to a minimum, thereby multiplying the number of actual experiments a single cell can accommodate.

Five semihot cells of a more conventional type are used for work with materials somewhat lower in radioactivity. The top of a cell resembles the hood over a kitchen stove. A laboratory technician uses tongs to work with semihot atoms behind a shield of lead bricks, with mirrors and thick glass portholes to aid vision.

The Hot Lab's Semi-Works area contains handling facilities and wide floor space for construction and operation of equipment. Its use can range from preassembly of hot-cell experimental equipment to the building of a pilot plant for evaluation and development of industrial processes.

Samples of materials can be placed in small tubes and whisked underground at 40 mph from the reactor to the Hot Lab. Short-lived radioisotopes can thus be delivered into a hot cell for immediate use before they lose their radioactivity.

Experimental equipment exposed to highly radioactive sub-

stances is taken to a "cleanup" decontamination room. To make cleaning easier, part of the room is lined with stainless steel, part with tile. When necessary, intensive scrubbing, with soap and water or with acids, takes place in a polished stainless-steel dunking tank 5 ft deep, resembling a miniature swimming pool.

All the ventilating air in the Hot Lab is passed through filters to remove possible air-borne contamination.

Waste liquids from experiments pass through drain lines to hold-up tanks, where they are monitored by Geiger counters and similar detection devices, then analyzed to determine radioactivity levels. If no significant radioactivity can be detected, the waste is discharged in normal manner through a regular sewer. Other wastes are treated and diverted to one of several storage tanks. Radioactivity prevents entry of personnel to the waste-treatment area, a labyrinth of tanks and pipes under the Hot Lab building. Therefore, pressures, temperatures, and other data necessary to supervision are registered on control panels upstairs.

A detachment of the Health Physics staff is assigned to the building to supervise protection of personnel. A double-locker room is provided to keep street clothing separate from work clothing.

High-Strength Harness

A NEW high-strength shoulder harness designed to provide greater protection in case of a crash is now undergoing final tests before being standardized for all USAF pilots, it is reported in the CADO *Technical Data Digest*, January, 1951.

The Air Materiel Command's Aero Medical Laboratory reveals that human guinea pigs have used the new harnesses effectively up to 38.6 *g*. Tests with the presently used shoulder strap and lap belt proved that 17 *g* was about the limit a man would stand voluntarily.

Changes made in the old harness were relatively minor. Aero Medical Laboratory engineers improved the strength of the webbing and distributed the force to the strongest parts of the human body, i.e., the hips, thighs, and shoulders.

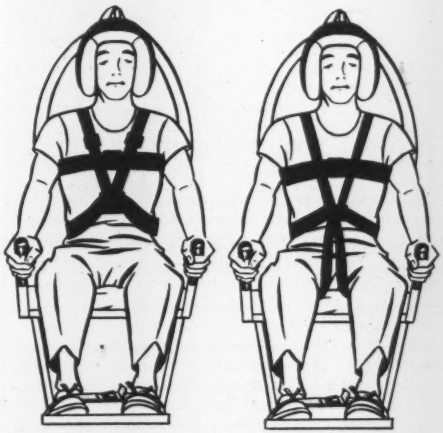

FIG. 10 DESIGNED TO PROVIDE BETTER PROTECTION IN CASE OF A CRASH, NEW AIR FORCE SHOULDER HARNESS (*right*) FEATURES INCREASED STRENGTH OF WEBBING AND BETTER DISTRIBUTION OF FORCES TO THE STRONGEST PARTS OF THE HUMAN BODY

Medical researchers believe man can survive 35 to 40 *g* with the present equipment, but the lap belt tightening across the upper abdomen might leave him helpless in so far as getting out is concerned. This has been borne out by USAF flying safety engineers who found some crashed pilots had burned to death even though they had no broken bones or anything else that would prevent them from escaping.

The new pilot harness, Fig. 10 (*right*), with an inverted "V" crossing the pilot's thighs, has been successfully tested with both seat and back parachutes. It was also designed so that it will fit the hardware on the many different varieties of seats used in the Air Force. And it will not interfere with the operation of the pilot ejection seat in any way.

The new harness is made of a nylon material having a tensile strength of 9300 lb while the present model has only a 4000-lb tensile strength. The straps are $1\frac{5}{8}$ in. in width stiffened by three thicknesses of nylon webbing. All this is necessary because at 35 *g* there are about 3000 lb of pressure on the lap belt, 1600 lb on the leg straps, and 2000 lb on the shoulder straps.

The equipment still puts plenty of pressure on the pilot when he jams to a stop at 30 or 35 *g*'s but all the pressure is not concentrated on the abdomen. It is a lot easier to take the "kick" when it is distributed to your shoulders and legs as well.

It is also pointed out that the new harness provides between 225 to 275 sq in. of surface against the body (dependent on the size and weight of the pilot), while the M-16 now in use gives only 75 to 125 sq in. of covering.

Final tests to determine how comfortable the equipment is are now under way, but Aero Med officials believe that it is no more uncomfortable than wearing a parachute on a lengthy flight.

Research Compressor

THE National Gas Turbine Establishment, Ministry of Supply, Whetstone, Leicestershire, England, has recently developed a simple gas-turbine research compressor for the rapid determination of compressor-stage characteristics with various blade forms, in which water is used as the working fluid instead of air. The apparatus is described in *Engineering*, Dec. 8, 1950. Since, in an axial-flow compressor, the pressure rise across each stage of the compressor is small, compressibility of the working fluid has a relatively minor effect on the blading performance until speeds corresponding to the critical Mach numbers of the blades are approached. It has been found that the water compressor shows all the characteristics of the normal air compressor, apart from such compressibility effects. The rig can be adapted to perform a wide variety of tests.

For compressors of the same size, blading design and pressure rise, the flow velocities, rotational speed and power absorbed by the air compressor are 28.6 times those of the water compressor, and the centrifugal stresses (assuming the same materials of construction) are in the ratio 816:1. The much lower centrifugal loading, when water is employed, allows cheaper materials and simpler forms of construction to be used. At the lower velocities, too, instrumentation is simplified. It is, moreover, easier to observe visually the flow of water.

The research compressor consists of three identical stages of blading, with an inlet-guide row, in a parallel annulus of 9 in. internal and 12 in. external diameter. Blade chords up to about 1.5 in. can be used, giving aspect ratios of 1 or higher. The normal running speed is about 150 rpm, at which the compressor absorbs about $\frac{1}{4}$ hp. The machine is completely submerged in water, and is mounted with its axis vertical in a cylindrical tank, forming a return circuit, with upward flow

through the compressor. A variable throttle is provided by a sliding flared discharge tube acting in conjunction with the fixed top cover of the tank. Radial vanes and perforated plates in the return-flow annulus serve to dissipate swirl in the discharge. The compressor is driven through reduction gearing by an electric motor. A transparent half-casing on the compressor allows the flow to be observed visually. To prevent the return flow from obscuring the view, a sheet-metal tunnel is provided. In normal testing, speed and power measurements are recorded, and pressures are measured on single-limb manometers from wall tappings near the bottom of the tank, and in the compressor casing at the inlet and outlet and between each row of blades. This allows the compressor-stage characteristics to be determined rapidly.

The constructional materials of the compressor are mainly wood, Tufnol, Perspex, and light alloy. It is easy to change the blades and, because of the simple and economical construction, modifications are easily made. Owing to the low centrifugal loading, the low-melting-point alloys, although heavy, soft, and of low strength, are suitable for blade materials and allow a simple and rapid method of manufacture to be used. Up to the present, Wood's metal, a tin-bismuth-lead-cadmium alloy, has been used. The blades are cast in wooden dies at about 100 C with integral roots of T-form. The only finishing operations required are light hand dressing, to remove the flash, and polishing the profile. Up to 200 blades have been cast satisfactorily from one set of dies. The accuracy of the profile can be kept within the tolerances normally allowed for blades.

Temperature-Response Measurements

EFFICIENT operation and adequate protection of the power plant in jet engines requires rapid reduction in the temperature of the gas stream whenever this temperature exceeds a limiting safe value.

Recently A.I. Dahl and E.F. Fiock of the National Bureau of Standards have developed apparatus which determines the rate of response of jet-engine temperature elements under conditions very closely approximating those obtained in the combustion stream. With this equipment, response times as short as 0.02 sec have been measured for a wide variety of thermocouples, resistance thermometers, and thermistors.

The apparatus consists essentially of a jet-engine combustor, or burner, with provision for mounting instruments in the exhaust-gas stream, and a device for producing rapid changes in the temperature of the mounted test instrument. A compressor or blower supplies air to a single Jumo 004 turbojet-engine combustor equipped with its normal fuel injector and spark plug. Exhaust gases from the combustor pass through two 90-deg turns, through a perforated plate, and then through about 10 ft of straight pipe before reaching the test section, which has three convenient hatches for mounting instruments. In this way the gas stream is kept at essentially uniform temperature and velocity over the central half diameter of the test section, and exposure of any instrument to direct radiation from the flame is prevented by the turns in the duct system.

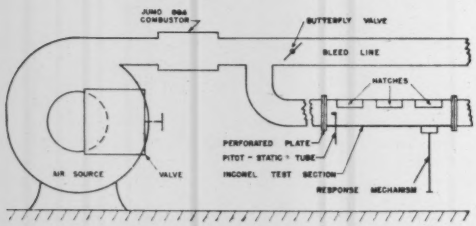

FIG. 11 SCHEMATIC DIAGRAM OF TEST SYSTEM EMPLOYED AT THE NATIONAL BUREAU OF STANDARDS TO STUDY THE RESPONSE RATES OF TEMPERATURE-SENSING DEVICES FOR JET ENGINES

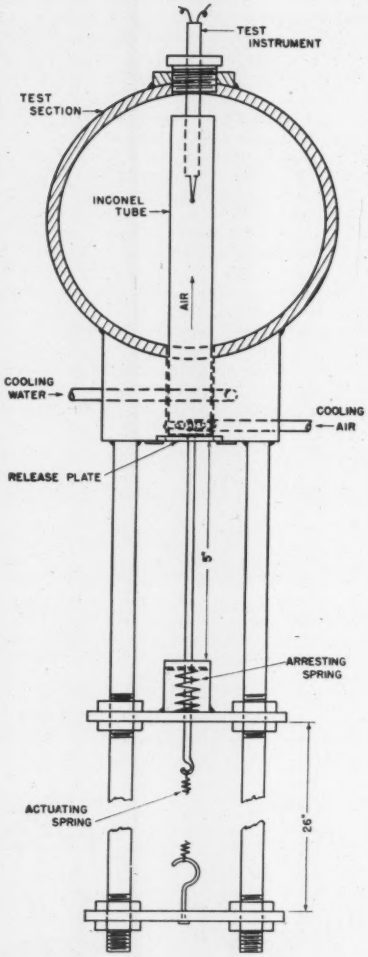

FIG. 12 DIAGRAM OF APPARATUS DEVELOPED AT THE NATIONAL BUREAU OF STANDARDS FOR RAPIDLY CHANGING THE TEMPERATURE OF THE GAS SURROUNDING A JET-ENGINE TEMPERATURE-SENSING ELEMENT

The gas temperature and flow rate at the combustor outlet are controlled by means of a valve at the inlet to the compressor

and by adjusting the fuel pressure. A bleed line containing a butterfly valve also provides an auxiliary control of the flow in the test section, independent of the operating conditions of the burner. Pressures observed with a Pitot static tube, together with the known value of gas temperature, permit calculation of the mass flow rate in the test section.

For measuring rate of response, the temperature of the gas surrounding the test instrument must be changed very suddenly. This cannot be accomplished with sufficient rapidity by controlling the combustor. Apparatus was therefore developed for quickly immersing the instrument without altering the steady flow of exhaust gas in the test section. In this device, an Inconel tube, projecting vertically upward through the test section and held in position around the test instrument by a release plate, provides a flow channel for cold air. When the release plate is pulled out of the way, a spring suddenly removes the tube, exposing the instrument to the hot gas of the main stream almost instantaneously. During the downward movement of the tube, the supply of cold air is stopped automatically. In this way a test instrument at a known moderate temperature (controlled by the air rate through the Inconel tube) can be brought in contact with exhaust gas at any given temperature and at any mass flow rate within the capacity of the system.

Two systems of this kind are now in operation at the Bureau. Air for one is supplied by a blower with a capacity of 4000 cfm of free air, and air for the other is provided by centrifugal compressors having a combined capacity of 10,000 cfm. The systems have identical Inconel test sections, about 6 in. in diam. The second system can be operated at temperatures up to about 2000 F, and at mass flow rates up to 15 lb per sec per sq ft in the 6-in. test section. A 3-in-diam test section is used in endurance tests and in research where velocities up to 1800 fps are of interest.

The apparatus has been used at the Bureau to study the performance of temperature-sensing elements exposed directly to the gas stream, elements encased in metal and ceramic protection tubes, and elements embedded in insulating materials such as quartz and beryllia.

Gas-Turbine Airliner

ANOTHER British gas-turbine-powered airliner, the Armstrong Whitworth Apollo, will be making a series of proving flights later this year, according to The Society of British Aircraft Constructors. The Apollo, which has been granted its Certificate of Airworthiness for passenger carrying, was the second turboprop airliner in the world to fly and of special importance since it was the first to have axial-flow-type engines.

The axial type differs from the centrifugal in the method of feeding air into the combustion chambers. It also has a small diameter and the slim nacelles of the Apollo's four Mamba 1200-hp engines are an indication of the low drag of the axial turbines.

The Apollo is a luxuriously furnished airliner designed to carry 25 to 40 passengers over medium-stage lengths between about 200 and 900 miles. It can carry 40 passengers over 860 miles at 305 mph. It cruises at 20,000 ft above the weather, and high enough for passengers to take full advantage of the smooth vibrationless cabins of the turboprop airliner. Its low operating costs are said to be typical of the economic flying and maintenance of gas-turbine-powered airliners.

The first prototype Apollo flew in 1949 and has since flown over 200 hr. The second prototype, now being built at Coventry, will have more powerful Armstrong Siddeley Mamba engines and a fully pressurized cabin.

Free-Piston Power Plant

ADDITIONAL details on a revolutionary free-piston power plant for Diesel operation which combines the thermal efficiencies of conventional Diesel engines with the advantages of gas-turbine operation are contained in a report now available to the American public, the Office of Technical Services of the U. S. Department of Commerce announced recently.

The new report, supplementing information on this French development previously published in the United States, deals with the problem of obtaining operating stability in the floating-piston gas generator. According to the report, this achievement has been possible despite the absence of connecting rod and crankshaft linkages.

The free-piston gas producer is actually a highly supercharged 2-cycle Diesel engine. A piston-driven engine produces exhaust gas at 75 psi pressure and a temperature of 900–950 F. The useful power comes from a gas turbine in which exhaust gas is expanded to atmospheric pressure.

This report, PB 100 124, "Operating Stability of Floating Piston Gas Generators," 19 pages, including photographs, drawings, and graphs, sells for $1.75 in microfilm, $2.50 in photostat form. Orders should be addressed to the Library of Congress, Photoduplication Service, Publication Board Project, Washington 25, D. C., accompanied by check or money order payable to the Librarian of Congress.

Cobalt

BY the end of 1952 the United States will have 4¼ million lb of cobalt annually from domestic and Canadian ores, according to an article by John V. Beall, in *Mining Engineering*. U. S. consumption of cobalt immediately prior to the present national emergency was 8 million lb annually, 90 per cent of which is imported from the Belgian Congo. The new sources of cobalt being developed are ore bodies near Salmon, Idaho, Fredericktown, Mo., and the Cobalt, Ontario, ore bodies in Canada. It has become possible to exploit these sources commercially because of the development of a new process to recover cobalt from complex concentrates containing arsenic or nickel.

On November 21 the National Production Authority issued an order limiting consumption of cobalt to 30 per cent of previous usage by nonessential industries. By February, 1951, the article states, cobalt was restricted to defense order consumption. This is because the supply of cobalt available is limited to about 8 million lb, mainly from the Belgian Congo, and this is needed for the rearmament program. Television, porcelain, paint, ceramic, and novelty consumers of cobalt are hard hit by these restrictions. Only the munitions Board can estimate the military requirements of cobalt but reliable sources say that as long as wartime conditions prevail, all cobalt produced will be needed for national defense.

The largest use of cobalt is for permanent magnets which have a wide variety of military and nonmilitary uses. Cobalt magnets are the most efficient permanent-type magnets. Where weight and space are vital, the cobalt-alloy magnet materials are indispensible. For instance, in instruments used in guided missiles, magnets must frequently be contained in an enclosure no more than 1 in. in diam. In the extremely high-performance Alnico alloy, cobalt is alloyed with nickel and aluminum.

Cobalt in tool steels improves cutting performance at high speeds and red heats. Cutting tools made of powdered tungsten carbide are bonded with cobalt to make an extremely efficient and heavy-duty cutting tool. From 3 to 20 per cent cobalt is required for this use.

The past decade has seen the development of the so-called refractory or high-temperature alloys capable of maintaining strength at operating temperatures of 1600 F or over, and capable of resisting creep, wear, corrosion, and erosion. More than 40 such alloys have been developed and at least 13 contain cobalt ranging from 13 to 66 per cent. The alloys were designed for components of gas turbines, jet aircraft engines, and turbosuperchargers. Vastly greater amounts of cobalt will be required by expansion of military requirements, but the impact of consumption for this work has not been realized fully.

The ceramic industry uses cobalt to provide the blue color as in the familiar Bromo Seltzer bottle. Cobalt oxide is used in frit or ground coats in porcelain enamelware because it enhances bonding at the steel-enamel interface. Salts of cobalt are used as driers for paints and varnishes. Much success has been achieved by using cobalt to supplement pasture deficiencies in cattle raising.

Use of cobalt in the coming months will be restricted to essential production, Mr. Beall points out. A certain amount of substitution for cobalt in alloys is possible but the substitution is usually the replacement of cobalt with another critical material.

At present nearly all cobalt consumed in the United States comes from one company, the Union Miniere du Haut-Katanga, which recovers the metal as a by-product of copper mining in the Belgian Congo. The United States is presently receiving 90 per cent of the production of this company and no increase can be expected. The next biggest producer is Rhokana Corporation in Northern Rhodesia but all this production goes to the United Kingdom. ECA money is being used to increase output at Rhokana. ECA has made a contract to purchase 7200 metric tons of cobalt ore from French Morocco, to be delivered by November, 1952. This ore will yield about 2 million lb of cobalt metal.

According to the *Mining Engineering* article, the history of cobalt has been one in which the supply always exceeded the demand except for short periods during the two world wars. This situation has held back the recovery of cobalt from cobalt-bearing ore bodies. Cobalt is usually a by-product of the mining of some other metal. In the United States it has not been commercially possible to save the cobalt from these ores because of the complicated process of separating it from nickel or arsenic, which are frequently found with cobalt. However, the Chemical Construction Company is reported to have worked out a new process which will recover the cobalt from the Idaho and Missouri ore bodies. Details of this process will be announced in the near future. A new cobalt refinery is being constructed near Salt Lake City, Utah, to treat the Idaho concentrates. The plant is expected to be in operation this year and will have an annual capacity of from 2 to 3 million lb.

Missouri cobalt will be recovered from concentrates which have been saved from the mining of lead and zinc ores. It is expected that this source will yield $\frac{1}{2}$ million lb annually. It is proposed to recover cobalt from the famous old silver mines of Cobalt, Ont., Canada. These mines produced fabulous amounts of silver from 1900 to 1920, but the mines have been dormant until recently. The high price of silver, new discoveries, and technological advances have caused many of the mines to be reopened. In mining the silver, cobalt ores are developed but much cobalt is also contained in the silver ores. This district will account for approximately $\frac{3}{4}$ million lb annually when the projected cobalt refinery is completed.

Barring curtailment of shipping in the Atlantic and with the completion of present plans on the North American Continent, the U. S. position in cobalt by the end of 1952 should be as follows: Belgian Congo, $7\frac{1}{2}$ million lb per yr; French Morocco, 1 million lb per yr; Idaho, 3 million lb per yr; Missouri, $\frac{1}{2}$ million lb per yr; and Cobalt, Ont., $\frac{3}{4}$ million lb per yr; giving an annual total of $12\frac{3}{4}$ million lb.

A Businessman's Responsibilities in Rearmament

(*Continued from page 210*)

6 Take an active personal interest in college problems, and participate in discussions devoted to their solution.

These things aren't easy—they take time and money. But they are important.

RESPONSIBILITIES AS INDIVIDUALS

I've been talking about what we all can do in the current situation as responsible businessmen. Regardless of how we make our living, we also have responsibilities as individuals.

Last year I compiled a number of ideas from various people in attempting to determine what any earnest, sensible, well-meaning individual could do to combat the trend toward a socialistic state to combat the encroachments on that all-important "freedom of choice." These ideas still make sense. They are as follows:

1 We have got to get informed.

2 We must recognize that many proposals for reforming the American economy stem from real problems.

3 We must be for something, for progress and change, not merely against something.

4 We must spread the story of the American system, in terms everyone can understand and accept.

5 We must take a more alert personal interest in government, and implement our interest by personal action.

6 We must truly deserve the confidence of the people. We must earn their faith.

CONCLUSION

The pressures of the times ahead will require our strongest efforts, as businessmen and as individuals, to maintain the kind of society and economy we all want.

If we are lax, or selfish, or indifferent, or just plain stupid, we may allow our economy and our nation to suffer the ills against which we've been warned.

But these things will not occur if businessmen in the country carry their share of the responsibilities. Dr. Day, recently retired president of Cornell, put the problem this way: "The most serious of all threats to democracy is the indifference, complacency, and ignorance of those who have shared democracy's benefits." Let not that be said of us here today.

In our struggle to preserve the American system, we also will do well to heed a significant statement by John Stuart Mill, the truth of which, unfortunately, is only too well recognized by those who are working to destroy the American system. It goes this way:

"One man with a 'belief' is a social force superior to 99 men who have only an 'interest.'"

So it devolves on us to "believe" in the cause of America, not merely to be "interested" in it.

ASME TECHNICAL DIGEST

Substance in Brief of Papers Presented at ASME Meetings

Air-Cargo Transportation

Overhead and Floor Tow Conveyers for Air Cargo, by J. C. Webb, Mem. ASME, Jervis B. Webb Company, Detroit, Mich. 1950 ASME Annual Meeting paper No. **50—A-132** (mimeographed).

THE use of truck-towing conveyers offers a natural and economical method of sorting and distributing air cargo to delivery trucks. Towing conveyers also offer a fast and safe method of handling the cargo from the planes to the terminal building.

The overhead towline as used in transfer terminals usually consists of an overhead chain power-driven trolley conveyer running on an I-beam track about eight feet off the floor. At about ten-foot intervals a fixed ring, with a 2-in. opening, is suspended from the underside of this conveyer. Into this ring may be introduced a hook made out of, say, $^1/_2$-in. round stock. This hook is attached to the headgate of a four-wheel truck by two chains, one to each side of the top of the headgate. The hook itself is about 16 in. long, the chains about 18 in. long, and when the hook is lifted up and hooked into the eye, or fixed ring, on the overhead chain conveyer, the chain conveyer simply tows the truck along.

This conveyer may tow the four-wheel trucks spaced approximately on 10-ft centers all around the conveyer in just about any path the terminal planners desire. It can go to the right or the left or over practically any distance.

A towveyer form of conveyer, which is an improvement on the overhead tow system, is located in the floor of the terminal instead of being overhead so that there can be no obstruction at any height overhead to interfere with any special operations that might be required. The conveyer is installed entirely beneath the floor and consists of a chain suspended between two channels by ball-bearing wheels riding on the flanges of the channel. The chain has dogs on it which trap a vertical pin dropped down through a slot in the floor from the dolly truck.

A number of the trucks now in use have a 72 × 36-in. base, but it has been found recently, after considerable experience, that possibly a more useful truck for sorting individual shipments would be approximately 30 × 42 in.

However, almost any trucks, including two-wheel trucks now on hand, can be adapted for use on tow-conveyer systems.

Characteristics of Military Cargo Aircraft, Past, Present, and Future, by L. S. Rochte, Wright-Patterson Air Force Base, Dayton, Ohio. 1950 ASME Annual Meeting paper No. **50—A-134** (mimeographed).

NO single type of cargo aircraft will provide the answer to the air-cargo problem, this paper points out. The air cargo of the future—both military and commercial—will be transported by an integration of transport helicopters, pack-carrier aircraft—both fixed- and rotary-wing, and integral fuselage fixed-wing aircraft, into a supply system whereby the specific advantages of each can be fully realized.

Before the full effect of helicopters can be realized in an air-cargo operation of any proportion, much remains to be done to reduce maintenance requirements, increase cruising speeds, solve rotor-blade anti-icing problems, increase inherent stability, and otherwise design to permit full-scale operation with conventional aircraft in an all-weather Air Force.

The detachable cargo compartment, long a dream of air-cargo men, is now a reality in the Air Force's XC-120 aircraft built by the Fairchild Aircraft Division at Hagerstown, Md.

Considerable conjecture has been offered concerning the validity of this principle in which the expensive power unit is detached from the relatively inexpensive cargo unit, and the results of its testing by the Air Force are anxiously awaited by military and commercial circles.

According to the paper, future military cargo aircraft should incorporate the following characteristics:

1 Cargo compartment. It should be rectangular in profile and the loading ramp and doors, integral with the fuselage, when open, expose the full cross section of the cargo compartment. The cargo floor should be rugged and sturdy

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so as to accept heavy items of equipment at random at any location on its surface. The floor should be at truck-bed height. Tie-down fittings, flush with the surface and on a 20-in. grid pattern, should have sufficient strength to restrain the heaviest load in event of a crash landing and should be ample in quantity.

2 Landing gear. The landing gear must be rugged and free of maintenance problems. Sufficient bearing area must be available to permit operation off low supporting strength terrain such as mud and sand.

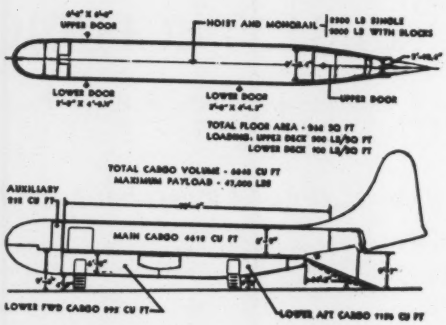
3 Crew compartment. The crew compartment must conform to the latest military specifications for cockpit standardization. There should be excellent visibility of the ground, the sides, forward, and overhead.

4 Maintenance. The design should incorporate every possible measure to reduce inspection and maintenance time to a minimum. Engines should be capable of being replaced easily and rapidly. Hydraulic, oxygen, fuel, and oil lines should be conveniently located. Instrument and accessory replacement should be easily accomplished. Radio and radar equipment should be readily accessible.

5 Emergency features. All fuel, as well as other inflammable liquids such as hydraulic fluid, oil, deicing alcohol, etc., should be as far removed from the fuselage as possible. Heretofore, too little attention has been paid by the aircraft designer to the incorporation of structural members in the fuselage nose, as well as the passenger compartment. Added protection may be accomplished for little or no weight penalty if designed into the aircraft on the drawing board. Emergency exits should be ample in size and adequate in quantity, and they should be located to meet all survivable crash situations. The design should incorporate the maximum in favorable water-ditching characteristics and must accommodate life rafts in accessible locations.

6 Performance. Major performance features for consideration are: Take-off and landing distances, one engine out service ceiling, range–pay-load relationship, cruising speed, and stalling speed. Cruising speeds and service ceilings should be reasonably high, stalling speeds, take-off, and landing distances low, and range–pay-load relationships flexible.

Versatility Plus Performance—The Boeing Stratofreighter, by Alan F. Kelsey, Boeing Airplane Company, Seattle, Wash. 1950 ASME Annual Meeting paper No. 50—A-142 (mimeographed).


HOIST AND MONORAIL
2500 LB SINGLE
5000 LB WITH BLOCKS
LOWER DOOR
LOWER DOOR
UPPER DOOR
TOTAL FLOOR AREA - 946 SQ FT
LOADING: UPPER DECK 500 LB/SQ FT
LOWER DECK 400 LB/SQ FT
TOTAL CARGO VOLUME - 6040 CU FT
MAXIMUM PAYLOAD - 47,000 LBS
AUXILIARY
MAIN CARGO 4610 CU FT
LOWER FWD CARGO 995 CU FT
LOWER AFT CARGO 1195 CU FT

STRATOFREIGHTER LOADING DATA

THE only change required to put a commercial Boeing stratofreighter into military operation would be the change in insignia—providing the CAA and military services eliminate the differences in their requirements and thus make the military transport certificable. The versatility of the stratofreighter makes it capable of doing both jobs.

The lack of standardization in requirements increases the cost of aircraft for both the commercial operators and the government. For example, the Air Force requires a Zone 1 (power section) fire-extinguisher system in the nacelle, the CAA does not. The increased quantity of CO_2 necessary for the military aircraft requires a completely different system from the commercial.

Although versatility is important to the commercial cargo aircraft, it is even more important for the military transport. The following variety of missions are expected of military transports: Personnel transport, standard cargo transport, transport of combat or heavy equipment, air evacuation, and aerial resupply.

A highly important operation for the military transport, which has no counterpart in commercial operations, is air evacuation of the sick and wounded. In the fall of 1949 a policy was established calling for all evacuation from overseas bases by air. This policy, which was based on peacetime requirements, was promulgated for reasons of economy as well as improved service for evacuees.

With the developments in Korea the need for rapid evacuation became urgent. The stratofreighter was immediately put into this service and actual operating experience showed that each airplane could transport 400 to 500 patients a month from Tokyo to Tripler General Hospital at Honolulu.

During the first few months of the Korean war the number of wounded averaged approximately 2900 men per month. Evacuation, quickly and comfortably, of all of these wounded from Tokyo to base hospitals in this country could have been accomplished with only ten stratofreighters had they been used exclusively.

The features of the Boeing stratofreighter providing for aerial resupply are as follows:

By means of 17 individual trolleys, each supporting 1500 lb, a total of 25,500 lb of supplies and equipment can be dropped in an area 150 ft wide × 2400 ft long.

It was reported that during some of the operations in Europe when paratroops were completely surrounded and had to be supplied only by air, only 10 per cent of the supplies were recovered on the ground. This poor recovery was due to the wide dispersion caused by the awkward method of pushing supplies out the door.

Pilots of the stratofreighter have stated that the change in aircraft trim is practically imperceptible even though 25,000 lb of cargo is released in 12 sec.

Considerable growth for the stratofreighter is predicted in the paper. With anticipated developments of the 4360 engine the present commercial airplane without structural change can increase from the presently certificated 145,800 lb gross weight to 153,000 lb. For military operation gross weights up to 174,500 lb have been demonstrated and normal take-off weights are in the vicinity of 155,000 lb. The differences between military and commercial operating weights are due to less restrictive military requirements for certain types of operations.

The development of a turbine-driven propeller for the stratofreighter would bring about increased take-off weights without increasing landing weights and accordingly keep within present field-length limits.

Increased wing span by means of a new center section is another possible development. This would permit a larger body which, combined with the turbopropeller, will provide higher pay-loads at increased speeds.

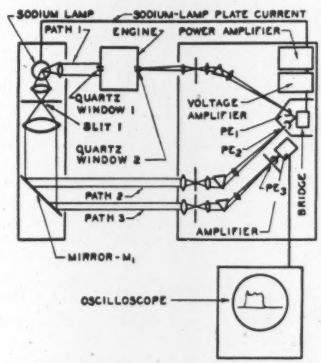
Oil and Gas Power

An Instantaneous and Continuous Sodium-Line Reversal Pyrometer, by M. M. El Wakil, P. S. Myers, Jun. ASME, and O. A. Uyehara, Jun. ASME, College of Engineering, Farduk I University, Alexandria, Egypt. 1950 ASME Annual Meeting paper No. **50—A-94** (mimeographed).

THE theory, development, and calibration of an electro-optical sodium-line reversal pyrometer are given. This pyrometer instantaneously and continuously determines and indicates the black-body temperature of a nonluminous flame made luminous at the sodium wave length by the addition of sodium. Typical data obtained on a spark-ignition engine are presented and compared with data obtained by previous investigators. A correlation of these data with combustion-chamber design indicates the possible existence of a high temperature in the flame front.

The sodium-line reversal technique developed by Kurlbaum and Fery has achieved general acceptance as a means of measuring the temperatures of nonluminous gases although it has not entirely escaped criticism. Adaptations of the Kurlbaum-Fery technique by Hershey and Paton, Lloyd-Evans and Watts, and Rasseweiler and Withrow have enabled point-by-point measurements to be made during the combustion processes in the spark-ignition engine. The data obtained in these investigations were the average values over a large number of cycles of questionable reproducibility. This reproducibility was even more questionable in the cases where it was necessary to stop the engine between the recording of the data for individual points. Furthermore, the experimental data represented a time average as well as a cyclic average since the stroboscopic shutter, of necessity, remained open for periods of as much as 18 deg of crank rotation. Nevertheless, the measurements were pioneering in nature and shielded valuable and interesting data on the combustion processes in the spark-ignition engine.

Since the sodium-line reversal method had achieved general acceptance as a means of determining the temperature of nonluminous gases, and since it had been successfully applied to point-by-point temperature measurements, it seemed logical to use the fundamental techniques of this method as the basis for developing an instantaneous and continuous temperature indicator for nonluminous flames. It is believed that the data obtained with this instrument will be valuable in combustion studies of the spark-ignition engine as well as in any other fields where the temperature of nonluminous gases are rapidly varying and temperature measurements are desired.



SCHEMATIC DIAGRAM OF ELECTRO-OPTICAL SODIUM-LINE REVERSAL PYROMETER

High-Pressure Compression-Ignition Engine-Turbine Cycles, by R. A. Harmon, Jun. ASME, and W. P. Green, Mem. ASME, Illinois Institute of Technology, Chicago, Ill. 1950 ASME Annual Meeting paper No. **50—A-95** (mimeographed).

SINCE the beginning of internal-combustion development in 1876, the prime object has been to get the most power out of the smallest engine at the highest possible thermal efficiency. Following this trend, and close on the heels of the four-stroke-cycle engine, came the two-stroke-cycle engine and the mechanically driven supercharger. Then, during the first World War, the gas turbine found its first really successful application in aircraft turbosuperchargers. It was not until 1927 that supercharging was successfully applied to Diesel engines, and it was in this same year Dr. Buchi started his own organization for the advancement of his ideas on turbosupercharging. Since then, turbosupercharging has gone through many and varied stages of development, and scores of different engine-turbine combinations have been proposed, built, and analyzed. However, the engine charge pressures for actual cycles rarely exceed 20 to 30 psia, and only a few theoretical cycles have been analyzed for higher charge pressures.

This analysis examines theoretically the effect of very high charge pressures on the performance of one particular combination. The geared compound-engine cycle in which the turbocompressor unit is geared to the engine shaft was chosen for the investigation because it was expected to afford the highest thermal efficiencies.

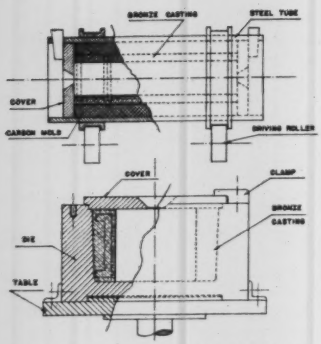
The most promising aspect of this particular cycle is the reduction in the size of the Diesel engine. Its high mep's indicate that the work output is quite large for a unit volume of cylinder displacement. The efficiencies show some increase over those of present combinations. The important thing is that efficiency curves are quite flat over the entire load range. The final and most important conclusion is that in order to obtain maximum efficiency for this cycle, it is necessary to supercharge the engine to approximately 55 psia.

The high work density and the comparatively flat efficiency curves, both indicate that this combination would be highly desirable for marine, truck, or locomotive installations. To broaden the field even more, this combination would be desirable for any application which has a limited amount of space and which is required to operate under variable-load conditions.

Centrifugally Cast Bronze-Back Bearings for Heavy-Duty Operation, by L. M. Tichvinsky, Mem. ASME, University of California, Berkeley, Calif. 1950 ASME Annual Meeting paper No. **50—A-106** (mimeographed; to be published in Trans. ASME).

FINE-grain-size and homogeneous structure are necessary for the bronze backs of heavy-duty bearings such as are used in modern Diesel engines. The finer the grain structure the higher are the physical properties of the bronze; the same can be said with respect to the homogeneity. Only the centrifugal method of casting bronzes for bearing back produces a material possessing the required high physical properties.

It is shown that localized porosity of the bronze back may lead to ultimate bearing failure. The inside diameter of a centrifugally cast bronze is always porous. Such porosity penetrates to various depths and is removed by machining during the initial stages of bearing manufacture. It is evidently desirable to cast bronze shells under such conditions that will result in minimum porosity.



HORIZONTAL AND VERTICAL MOLDS USED FOR CENTRIFUGALLY CASTING BRONZE BEARING SHELLS

Because of all these requirements, centrifugally cast bronze shells are periodically broken for visual examination of the fracture. This will reveal to the inspector if the area of fine and homogeneous structure, which will be left after rough-boring and turning a casting, will be sufficient for bearing manufacture.

For the purpose of economy, it is necessary to manufacture centrifugal castings with maximum sound material, i.e, minimum waste of defective bronze machined off on the four sides of a casting. Only well-controlled and rational methods of centrifugal casting will assure a good product at reasonable cost.

The over-all efficiency of centrifugally casting bearing bronze back may be considerably improved if the following additional factors will be carefully considered:

Temperature control should be as accurate as possible. Good pyrometers should be used—preferably not of the portable type because of easy damage.

Rate of pouring should be high and continuous.

Pouring should be done in some inert atmosphere, such as argon, to minimize or even eliminate porous bronze on the inside diameter.

Suitable mold material should be developed to have a long life, i.e., the number of castings made should be substantially increased over the present limit which varies between 200 and 500, depending on the die material and type of bronze poured.

Proper spraying, its technique, and materials used for it, also should be investigated.

Rigid, sturdy, and reliable casting machines will secure continuous, economical, and safe operation.

Steam Jet Compressors

Measurement of Flow Rate in Saturated-Air Test for Steam-Jet Ejectors, by R. C. Binder, Mem. ASME, Purdue University, Lafayette, Ind. 1950 ASME Annual Meeting paper No. **50—A-47** (mimeographed).

THIS paper discusses possible errors in measuring the flow rate in saturated-air tests of steam-jet ejectors. In some cases a small error in temperature may mean a large error in flow rate. An accurate test can be devised, but it would involve instrument complications that may not be practical from an industrial point of view and may be difficult to standardize. It is hard to control saturator test equipment. There are questions as to the real need for saturated-air tests and the correlation of tests using different fluids entering the ejector suction.

A solution to this problem of flow measurement is a test with dry air (or air and superheated vapor) for each stage and a test of the intercondenser between stages. This type of test is reliable, and can be made accurately without much difficulty. Further, the test results are convenient for studies of equipment performance.

Effect of Molecular Weight of Entrained Fluid on the Performance of Steam-Jet Ejectors, by W. C. Holton, Battelle Memorial Institute, Columbus, Ohio. 1950 ASME Annual Meeting paper No. **50—A-114** (mimeographed; to be published in Trans. ASME).

A PROGRAM of research sponsored by the Heat Exchange Institute involved pumping 13 pure gases and 12 mixtures of gases with small commercial single and two-stage steam-jet ejectors supplied by two manufacturers. Results were calculated in terms of "air equivalent" or "entrainment ratio," which is the ratio of the flow rate of gas to that of air under similar conditions. Entrainment ratios were found to be a function of the molecular weight of the gases handled and were plotted as a smooth curve, which is independent of pressure, design characteristics of ejectors, and is applicable to mixtures of gases. It is concluded that the curve may be used to predict results obtainable with any ejector system.

Another conclusion is that results obtained from testing both single and two-stage ejectors are comparable, regardless of the different absolute pressures maintained by the two machines. Independent of these data from the limitation of pressure permits extrapolation of the results to cover ejectors handling gases at absolute pressures lower than were maintained with the single and two-stage units.

Finally, the fact that the test points for mixtures of gases lie on the curve shows that this plot is not restricted for use with only pure gases. Since most ejector applications require use of mixtures of gases where molecular weight can be calculated, the applicability of the test results is thus greatly extended.

Effect of Temperature of Entrained Fluid on the Performance of Steam-Jet Ejectors, by W. C. Holton and E. J. Schulz, Battelle Memorial Institute, Columbus, Ohio. 1950 ASME Annual Meeting paper No. **50—A-115** (mimeographed; to be published in Trans. ASME).

AN investigation of the performance of small commercial single and two-stage steam-jet ejectors handling air and steam at temperatures to 1000 F was conducted under the sponsorship of the Heat Exchange Institute. The results of tests are expressed in terms of "entrainment ratio," which is the ratio of the flow rate of gas at a given temperature to that of the same gas at a base temperature. Entrainment ratio was found to be a linear function of temperature. The test results given appear to be independent of pressure and of design characteristics of the ejectors tested. Therefore the plot of the variation of entrainment ratio with temperature is, within the limits of the test accuracy, thought to be applicable to any ejector system.

Management

Predetermined Elemental Motion Times, by K. C. White, Cornell University, Ithaca, N. Y. 1950 ASME Annual Meeting paper No. **50—A-88** (mimeographed).

THE elemental motion standard approach to work standardization classifies the motions made by a person in carrying out a normal work assignment into fundamental elements considered to be common to any type of human work, and for each of these elements derives a standard time. In studying a method or in setting a standard time using this approach, it is necessary only to analyze the operation, list those fundamental elements required to perform it, and to add up the time standards for the elements listed to obtain the standard time for the operation.

Initial studies at Cornell have been concerned with the reproducibility by independent study of the data for a sys-

tem of elemental motion-time data. Since the full data for methods-time measurement with a reasonable complete discussion of element definitions was available as published in "Methods-Time Measurement" by McGraw-Hill Book Company, this system was chosen for study. Further, to obtain greater understanding of the system and some competence in its use, a training course in MTM was attended by one of the persons conducting the study.

The method of study and analysis used was similar to the one taken by Methods Engineering Council when the Methods-Time Measurement data were first developed, that is, by the detailed analysis of motion pictures taken of actual industrial operations. New films were taken in a variety of industries represented by eight different companies on operations ranging from small assembly and riveting operations to machines handling operations. Only incentive operations have been included in the study so far. An attempt was made to create a minimum of disturbance at the work place. The presence of the photographer of course could not be avoided, but supplemental lighting and tripod were not used. A small electric-drive camera designed and calibrated to take 1000 frames per min was used so that each frame represented 0.001 min of actual operation time. At the time the operation was filmed, the operator was rated in most cases by at least two individuals using the leveling-factor system of rating for skill, effort, and conditions.

The films were then analyzed in terms of the MTM elements in the operation, and from the frame count, the actual time for the element was determined. These actual times were then leveled to determine the time for a normal operator.

For any one detailed element, the volume of data collected by this approach so far is not great, but particularly for the elements of reach and move, the data are sufficient to plot a characteristic of time versus distance for each of these element classes as defined in the MTM procedure.

The data collected thus far appear to point toward the practicability of defining work elements in terms of fundamental elements of motion common to a wide range of industrial activity and the establishment of standards of time for these elements which are reproducible within the smaller limits than those normal to current time-study practice. In summary, for all elements the check studies have consistently ranged within approximately plus or minus one per cent of the MTM times. For individual elements, time differences between check times and MTM times in the order of 0.1 to 0.5 TMU's (0.00006 to 0.0003 min) are not uncommon and, as evidenced in the data in this paper, a few are larger. While some of these time differences do represent 5 to 10 per cent differences in time for specific elements, and in isolated cases as much as 20 per cent, they are not considered serious in application since any standard is made up of a composite of a number of elements, the majority of which are well within plus or minus 5 per cent. No reason is now apparent why continued study should not result in reconciling the differences which do exist. In some instances further data may alter the check time as pointed out before; in some, modification in the MTM times may be desirable; and in some instances, it is entirely possible that new elements or subclasses of existing elements may be necessary.

Opportunity Unlimited, by T. C. Gary, E. I. du Pont de Nemours & Company, Wilmington, Del. 1950 ASME Annual Meeting paper No. **50—A-137** (mimeographed).

MORE than ever before, in these days of thought control, industry seeks engineers with trained minds from which new ideas may flow and who are ingenious and industrious in the application of old ideas in new and useful ways.

Industry seeks among engineers the following:

Knowledge—the acquaintance with the requirements of the job, gained through education, training, and experience.

Creativeness—the ability to think along original lines and to offer ingenious suggestions.

Initiative—the ability to handle assignments without detailed instructions.

Analytical ability—the capacity to reason from cause to effect and to weigh and reconcile conflicting data.

Judgment—the ability to make sound decisions when some significant data may be lacking or questionable as to reliability, and the ability to guide oneself without definite rules.

Reliability—intellectual honesty in calculating the risks, and unerring effort to meet estimates and promises, which are commonplace in the engineering profession.

Quality of work—accuracy, thoroughness, and the facility with which your work can be followed by others.

Quantity of production—as measured by the standard set by others engaged in similar assignments.

Ability to learn new duties—the speed of grasping explanations, assimilating new information, and quick adjustment to changing conditions.

Ability to write and speak clearly—volumes have been written on the subject—the whole objective is to gain and hold receptivity on the part of the one addressed.

Ability to co-ordinate—to combine into a workable whole the foregoing characteristics.

Co-operation—the manner in which you handle relationships with others and your reaction to an opposing point of view.

Display these characteristics in your everyday work, whether you be a young civil engineer driving a bulldozer, or a young mechanical engineer at a drafting board detailing a simple mechanism, and observe judiciously the methods of each successful engineer with whom you work, and then the inherent supervisory ability you may possess will develop and be utilized. The very nature of engineering work promotes the development of supervisory ability as demonstrated by the advancement of engineers into administrative and management positions.

Railroads

Development of the Aluminum Tank Car, by Gilbert B. Hauser, Mem. ASME, Aluminum Company of America, New Kensington, Pa. 1950 ASME Annual Meeting paper No. **50—A-118** (mimeographed).

PRIOR to 1927, Aluminum Company of America believed that a good market for aluminum-tank cars might be developed. Consequently, when a Canadian company in that year asked for price and design of an aluminum tank for handling glacial acetic acid, it seemed that this might be the beginning of the aluminum-tank-car development. A design for a welded aluminum tank of 8000 gal capacity was made and submitted to the Tank Car Committee of the Association of American Railroads. It then appeared that approval of this aluminum tank would be difficult to obtain and so, without assurance that the car could be handled in interstate traffic, the prospective user lost interest.

The Aluminum Company of America than decided that an aluminum-tank car must be built for its own account and thoroughly tested on its own lines as a demonstration of the car's practicability. It was decided to have the car built by a regular tank-car manufacturer. The General American Transportation Corporation was selected because their Sharon plant was near Alcoa's New Kensington (Pa.) Works, thus facilitating movement of the required material and supervisory personnel. The car was finished and tested in August, 1928. It was of 8000

gal capacity, 78 in. ID × 32 ft long, of welded construction, and classified as an ICC-103 type. When ready for shipment to the Alton and Southern Railroad for road tests, Niacet Chemicals Corporation, previously advised of this project by General American Transportation Corporation, requested the loan of the car for operation under experimental permit and for regular shipments of glacial acetic acid. This plan suited all concerned and the car was placed in service in August, 1928. It was equipped with an impact recorder and, during 22,000 miles of operation, there was recorded a total of 3500 shocks, 900 of which were classified as severe. This performance was so eminently satisfactory to Niacet Chemicals Corporation that it wished to retain the car in its service; consequently, Alcoa embraced the opportunity to sell its interest in the car to General American Transportation Corporation. This car is in service today, although now used for shipping fatty acids. This, very briefly, is the history of the first aluminum-tank car.

Development of aluminum alloys by Alcoa and fabrication techniques by the car builders have consistently progressed toward production of the best possible aluminum-tank cars for shipment of the numerous commodities for which aluminum is best suited. The number of such commodities is constantly increasing and industrial requirements for large quantities for shipment in tank-car lots are expanding, so that by the end of 1950 there were in service over 1200 aluminum-tank cars. This figure is significant when it is considered that, up to 1949, just 550 had been built.

It is pointed out that the tank and its appurtenances are the only parts that are constructed of aluminum. The underframe, running boards, trucks, and other parts are of standard steel construction.

Design of the General American-Evans Damage-Free Car, by Richard M. Lamport, General American-Evans Company, Chicago, Ill. 1950 ASME Annual Meeting paper No. **50—A-119** (mimeographed).

USE of specially designed and constructed cars can materially reduce the railroads' annual rail loss and damage bill which in 1949 amounted to 125 million dollars, or nearly one fourth the railroads' total net income.

At present there is a fleet of 57,000 such damage-free cars operating in leased service on a number of the country's railroads. They are principally tank cars, but include refrigerators, stock milk, covered hoppers, flour cars, and various others.

The General American-Evans damage-free car was designed not only to eliminate injury to the lading, but also to increase the car load.

Reduction in the annual damage bill, while important in its own right, was only part of the answer. What the railroads needed was a car whose internal capacity could be more fully utilized. This may sound like oversimplification but with the available statistics in which everything was figured in ton-mile costs, it wasn't as simple to spot the fact that a substantial increase in net earnings could be effected by a 50 per cent increase in car load—from 34.4 tons in 1948 to 51.6 tons.

That increase in car load would jack up by more than 100 per cent the railroads' annual net income, 0.26 per car load per car mile as compared with the 0.11 earned in 1948.

Consequently, the designers were asked to develop a car that could be loaded higher and heavier, preferably with high revenue tonnage, and one that could travel safely, twice as fast, day after day.

The damage-free car has an 8-ft door to enable lift trucks to enter and leave more quickly. It is 50 ft 6 in. long and is designed to AAR specification for 50-ton all-steel boxcars, but contains a number of additional features.

For example, the floor is of low-alloy high-tensile steel which gives greater strength and three to five times greater resistance to corrosion.

The floor is welded to the side sills and four Z-section stringers, two on each side of the center sill. This floor provides exceptional additional strength to the underframe and the floor maintenance should be low for many years. The floor is coated with a nonskid odorless rubproof mastic which is rolled into the indentations in the floor strips, preventing movement under lift-truck wheels.

The car trucks have a lateral swing control for bolster and spring plank, coupled with a snubber designed especially for that truck.

The balanced suspension will absorb vertical shock through the relatively long-travel high-capacity coil springs coupled with the smooth-acting snubbers, and the lateral shocks by the pendulum action of the short self-aligning swing hangers. The design provides positive side-frame alignment by the combined rigidity of the spring plank and the hanger assembly.

The cushioned underframe reduces end shock. It includes an all-welded, single-spring, cushion underframe to give greater protection to both car and lading under horizontal shock incident to train handling in road service and switching.

On the basis of extensive service experience with much of the fleet already described, the builder believes that this cushioning device as installed on the General American-Evans cars, will not only reduce damage claims and car-repair costs but permit higher safe switching speeds, reduce slack action by 85 per cent, minimize hot boxes due to unseated journal bearings, and provide positive coupler centering by spring pressure on the coupler follower plate.

Metal-Cutting Data—Cutting Fluids

Basic Factors in the Hot Machining of Metals, by E. J. Krabacher and M. Eugene Merchant, Mem. ASME, The Cincinnati Milling Machine Company, Cincinnati, Ohio. 1950 ASME Annual Meeting paper No. **50—A-92** (mimeographed; to be published in Trans. ASME).

THIS paper presents the results of research on the influence of basic metal-cutting quantities when machining metals at elevated temperatures. Much of the investigation centered around some of the commoner high-temperature alloys. Studies on the mechanics of cutting at elevated temperatures were made in which such basic quantities as chip friction, shear strength, and machining constant were measured. In addition, tool-chip interface temperatures were calculated. These data were correlated with data obtained from milling tool-life tests on the same materials. The two main factors opposing each other in their effect on tool life in hot machining are the softening effect which increased temperature has on the tool and the abrading action of the chip and workpiece on the tool. It was found that these two factors can be roughly evaluated from tool temperature data taken in combination with data on the mechanics of cutting.

From the present research it is evident that the lower cutting forces and consequent lower power consumption achieved by hot machining are due mainly to reduced shear strength of the work material at high temperatures. Although this finding is not surprising, it does establish as fact what was previously conjecture only.

It does not follow, however, that tool life will always increase with increasing workpiece temperature. Instead, for a given work material, there is a definite temperature range for which tool life will be an optimum. This may be above, below, or at room temperature. For

some materials this optimum work material depends mainly on two factors, namely (1) the tool-chip interface temperature and (2) the abrading action of the work on the tool, which are both controlled by the mechanics of cutting. It appears that the product of thrust force and interface temperature provides a rough quantitative measure of these two factors.

Some of the basic factors in the hot machining of metals have been identified in the course of this research, and their role in the machining process clarified. In particular, a better insight into the factors influencing tool life has been obtained. The findings are thus not limited to the case of hot machining only. In addition, they suggest further avenues for research in the basic study of machinability.

Cutting Temperatures and Metal-Cutting Phenomena, by B. T. Chao and K. J. Trigger, Mem. ASME, Urbana, Ill. 1950 ASME Annual Meeting paper No. **50—A-43** (in type; to be published in Trans. ASME).

THIS paper considers some important findings which resulted from an investigation on the mechanism of heat generation during metal-cutting operations. It has been found that many changes during the cutting of metals are due to the change in tool-chip interface temperature through its influence on tool-chip friction. The paper is divided into two parts, the first of which pertains to the cutting forces and cutting temperatures observed during conventional turning and orthogonal cutting under otherwise identical conditions. The higher heat-dissipating capacity of the tool in orthogonal cutting operations was found to be fundamentally responsible for the observed differences. In the second part of the paper, the role of tool-chip contact area on interface temperatures is further investigated. This study has been of value in the interpretation of tool-chip interface temperature data and other phenomena heretofore inexplicable.

Fuels

The Combustion of Pulverized Coal Under Pressure, by W. E. Young and G. Opdyke, Jr., Westinghouse Electric Corporation, East Pittsburgh, Pa. 1950 ASME Annual Meeting paper No. **50—A-149** (mimeographed).

THIS paper describes the development of a suitable test equipment and presents the results of three series of tests in which the effects of air mass flow, air residence time, and burner pressure on completeness of coal combustion and ash particle size were determined.

While the combustion of pulverized coal at elevated pressures has been investigated experimentally by others, it appeared to be desirable to determine the operating characteristics of a small can-type combustor at pressures up to 5 atm and heat-release rates approaching those of existing gas-turbine equipment. It was realized that problems of loading and feeding of pulverized coal under pressure would be introduced, but these would eventually be encountered anyway, and much valuable experience might be gained at the outset.

The program was organized around the three series of tests. Burner pressure, air mass flow, and air residence time were taken as variables, one of which was held invariant in each series. In all tests, burner inlet and outlet temperatures were held at approximately 300 F and 1100 F, and the air-fuel ratio was essentially constant. Three size classifications of a Pittsburgh seam coal were burned at each condition. The air residence time was a computed value based on an assumed longitudinal velocity profile. It was proposed to make flow and temperature measurements from which completeness of combustion could be calculated, and to collect samples for ash particle-size analyses.

It should be noted that this investigation has been carried out with a small can-type combustor. Since the influence of scale effects on combustion was not explored, no claim is made that the findings can be generalized for other sizes or types of burners.

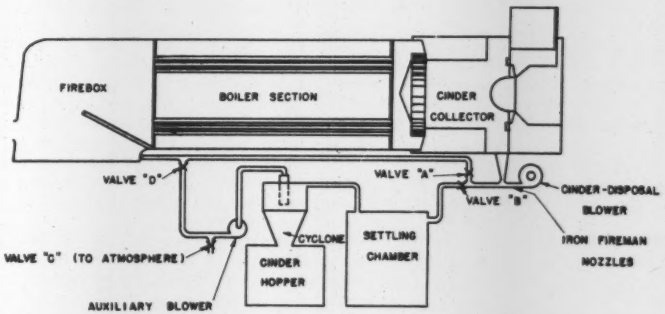
Based on completeness of combustion increasing with residence time it was concluded that: (1) An increase in mass flow has a beneficial effect up to the point of overloading the burner; (2) an increase in pressure has a detrimental effect on efficiency, but the effects of pressure and mass flow are not nearly so marked as the effect of residence time; (3) for any given condition, fine coal burns more completely than coarse coal; (4) the average particle size of the fly-ash product is markedly affected by the number of agglomerates which apparently form on the burner walls; (5) the variation of average ash particle size with changing burner conditions is small but marked, and, based on the assumption that an increased residence time in the burner would decrease the particle size, this variation indicates that the average size of the product is directly proportional to burner pressure, and inversely proportional to mass flow.

These results are in agreement with those of previous investigations which showed that completeness of combustion should increase and ash particle size should decrease with an increase in residence time.

Collection and Burning of Locomotive Cinders, by E. J. Boer, Jun. ASME, J. M. Allen, and B. A. Landry, Mem. ASME, Battelle Memorial Institute, Columbus, Ohio. 1950 ASME Annual Meeting paper No. **50—A-105** (mimeographed; to be published in Trans. ASME).

SUBSTANTIAL savings in railroad fuel consumption can be effected by the use of double-screened coal and the burning of locomotive cinders, but when both methods are used in combination the reduction in coal consumption may be as high as 16.4 per cent.

Since the application of the stoker to the coal-fired steam locomotive, the firing rates on the locomotive have been increased to values far in excess of the rates at which coal is generally burned. These high rates of firing have resulted in



SKETCH OF EQUIPMENT USED IN DISPOSING OF CINDERS DURING REINJECTION TESTS AND DURING EXTERNAL-STORAGE TESTS

high rates of cinder emission from the stack which, when measured in terms of heat lost, may amount to as much as 40 per cent of the heat contained in the coal fired. Both from the economic and the nuisance viewpoints, this emission of solids is undesirable.

Standing tests with a Norfolk and Western Railway locomotive, equipped with a cinder collector designed at Battelle, were conducted to determine the percentage collected and the percentage burned when returned to the firebox. Results indicated that an average of 80 per cent of the cinders are separated from the flue gases and about half of the reinjected cinders are burned. The greater part of these cinders burn in the bed, releasing their ash on the grate.

At the highest rate of burning, fuel consumption was reduced 10.5 per cent and the stack emission was reduced 55 per cent by collection and reinjection of cinders from the resultant size coal. Substitution of a double-screened coal for the resultant size gave, with collection and reinjection, an over-all reduction in fuel consumption of 16.4 per cent and a reduction in stack emission of 65 per cent.

Petroleum Mechanical Engineering

Recommended Practices for the Cleaning of Turbine Lubricating Systems After Service, by F. E. Rosenstiehl, The Texas Company, New York, N. Y. 1950 ASME Annual Meeting paper No. **50—A-116** (mimeographed).

THIS paper stresses the necessity for co-operation between the turbine builder, the operator, and the oil supplier, and includes specific instructions for proper cleaning.

Although adequate purification during circulation, through use of oil-purifying equipment, will go far to prevent build-up of insoluble foreign matter in the system, periodic inspections are essential to show whether proper maintenance practices are being followed and to reveal any contamination of the oil by impurities and foreign matter that may have found their way into the system. When a turbine is placed in service, a close watch should be kept until operating conditions have stabilized and when a new turbine is taken down for complete general inspection within the first year, as generally recommended by the builder, there is excellent opportunity to examine the oiling system for evidence of deposits, corrosion, or abnormal wear. It is also common practice to take frequent samples of the oil for visual inspection for the presence of water, emulsions, or suspended matter.

A marked change in the oil temperature differential across the cooler with no change in water flow or water temperature may indicate excessive build-up of deposits on either the oil or water side of the cooler or both. Hot water or steam washing, or petroleum flushing oil, are usually employed for cleaning the oil side of coolers. When using hot water, boiler feed at above 180 F is forced through at high velocity. Bearing pedestals and oil reservoirs are cleaned by directing a stream of hot water against the surface. However, clean dry air should be applied immediately thereafter, and, since steam or hot water will remove protective oily films, the system should be protected as quickly as possible with rust-inhibiting turbine oil or flushing oil to prevent rusting.

On the other hand, in some instances where a lightly sludged unit cannot be taken out of service for a time sufficient for thorough cleaning prior to an oil change, continuous by-pass circulation of the oil, through a clay filter, has been employed to remove the contaminating products. But as the clay will also remove the inhibitors, it is suggested that the oil supplier be consulted before employing this procedure.

The Maintenance and Servicing of Hydraulic Units for Machine Tools, by J. Howard Groom, Cincinnati Milling and Grinding Machines, Inc., Cincinnati, Ohio. 1950 ASME Annual Meeting paper No. **50—A-143** (mimeographed).

THE use of hydraulic systems for machine tools has become a widespread and accepted practice by many of the leading machine-tool manufacturers, and therefore the servicing of such systems becomes a matter of vital interest to engineers whose responsibility may be to keep machine tools in operation at all times, and to avoid production breakdowns, due to improper or inadequate maintenance. This paper attempts to show how this may be done both from the standpoint of preventive maintenance as well as regular maintenance or servicing of hydraulic systems.

A lack of proper maintenance of such systems has, in many instances, caused unnecessary trouble and expense.

A prerequisite to the proper maintenance of hydraulic systems on machine tools is a basic understanding of hydraulic valving and how hydraulic circuits operate.

Much can be done from a preventive-maintenance standpoint by using the correct hydraulic oil for each particular application, and by a thorough check-up at regular intervals to see that no contaminants are entering the system.

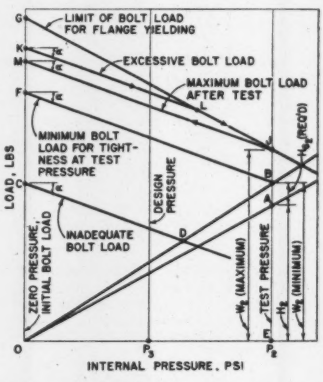
When corrective maintenance becomes necessary, it is imperative that a skilled man, who understands the principles of hydraulics, be assigned to the job.

A Design Procedure for Integral Flanges With Tapered Hubs, by W. F. Jaep, E. I. du Pont de Nemours and Company, Inc., Wilmington, Del. 1950 ASME Annual Meeting paper No. **50—A-50** (in type; to be published in Trans. ASME).

THIS paper develops a simplified method of applying the ASME flange-stress formulas to the design of integral flanges with tapered hubs. In the course of this development, the hub shape is predetermined and graphs are presented to permit a rapid solution of the stress equations.

Effect of Internal Pressure on Stresses and Strains in Bolted-Flanged Connections, by D. B. Wesstrom, Mem. ASME, and S. E. Bergh, E. I. du Pont de Nemours and Company, Inc., Wilmington, Del. 1950 ASME Annual Meeting paper No. **50—A-51** (in type; to be published in Trans. ASME).

IT is shown that the elastic deformations, and, therefore, the forces and moments, in a bolted-flanged connection vary with the magnitude of the internal fluid pressure, and that the actual conditions existing in a bolted joint will be considerably different from those assumed when



RELATION BETWEEN BOLT LOAD, PRESSURE LOAD, AND GASKET LOAD, WHEN BOLT LOAD DECREASES WITH INCREASING INTERNAL PRESSURE

using the concept of design upon which the rules of ASME Unfired Pressure Vessel Code must be based. For certain critical ranges of joint diameter, pressure, and stress, it becomes important to analyze the design for the actual conditions that will be obtained (*a*) in assembling the joint, (*b*) at test pressure, and (*c*) in service. Formulas are derived for calculating these conditions and the results are summarized in the form of a design procedure.

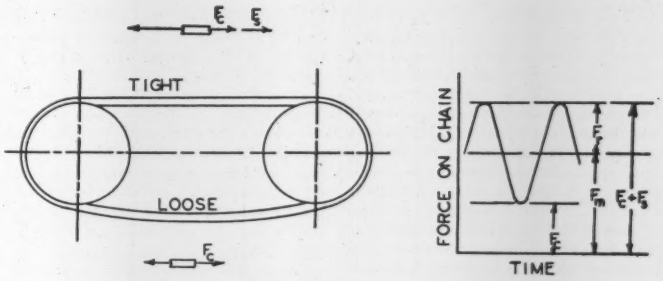
Formula for Pipe Thickness, by W. J. Buxton and W. R. Burrows, Standard Oil Company (Indiana), Whiting, Ind. 1950 ASME Annual Meeting paper No. 50—A-62 (mimeographed; to be published in Trans. ASME).

THE so-called Lamé formula, either in its true form, or in an equivalent but less complex modified form, is advanced as the most suitable formula for the design of pipe that is stressed in the elastic range by internal pressure. In the creep range, the use of the Bailey-Nadai formula is proposed, and it is shown that the so-called Lamé formula in either form is a good approximation of the Bailey-Nadai formula. In the selection of these two formulas, the so-called Lamé formula and the Bailey-Nadai formula, an examination has been made of the Common, Average (Membrane) Barlow, Clavarino, Guest, Beltrâmi, and von Mises formulas. The origin and meaning of all of these expressions are discussed. Their significance for design purposes is explained, and their relationship to the so-called Lamé formula is demonstrated. The need for additional pure shear experimental data on creep and on stress rupture is emphasized.

Machine Design

Determination of the Dynamic Coefficient of Friction for Transient Conditions, by G. G. Gould, White Oak, Silver Spring, Md. 1950 ASME Annual Meeting paper No. 50—A-61 (in type; to be published in Trans. ASME).

A NUMERICAL value cannot be assigned to the coefficient of sliding friction between two materials. For most friction-clutch and brake applications, the friction forces during the first 2 min of operation are of primary interest; however, during this time these forces do not remain constant even under otherwise steady operating conditions. Curves, derived from experimental data, are presented showing the behavior of friction during this transient period for many different combinations of friction materials and mating surfaces.



STATIC AND INERTIA FORCES ON A CHAIN DRIVE

It is concluded that a numerical value for the coefficient of friction between two materials has no real significance. For many applications this is a valid conclusion. However, since in engineering design it is necessary to perform calculations prior to fixing on a definite design, knowledge of the effect of the friction forces is necessary. The more accurate designation of the effect of sliding friction, during the first few minutes of slip, is a friction versus time plot for an empirical equation approximating this.

Dynamic Loading of Chain Drives, by William K. Stamets, Jr., Jun. ASME, Seattle, Wash. 1950 ASME Annual Meeting paper No. 50—A-25 (mimeographed; to be published in Trans. ASME).

THE present method of selecting a chain drive involves establishing the pitch on the basis of rotative speed of the sprockets and the power requirement. Having selected the pitch, the width of chain is found by determining either an allowable chain load or an allowable horsepower per inch of width and comparing these with design requirements. These allowable properties are based upon both pin wear and fatigue. To some extent, the effect of dynamic loading is taken into account by applying shock load factors to the design requirement and by subtracting centrifugal force directly from the allowable chain load. Often this second practice leads to a chain speed limit which is unnecessarily low. Most machine-design textbooks, even the most recent ones, state that usual chain speeds are 1200 to 1500 fpm. Some limit maximum chain speed to as low a speed as 2500 fpm, based partially on the effect of centrifugal force.

Recent experience with chain drives shows that if chain speed is increased for a given horsepower, fatigue life is likewise increased. For this reason, many engineers believe that centrifugal force in the chain is passed to the sprockets and hence does not exist in the maximum-loaded portions of the chain drive.

During the past 15 years, publications on chain dynamics were relatively few. Most publications gave little or no attention to the effect of centrifugal force, and none attempted a correlation between theory and practice. A more recent analytical study of sprocket impact presented a new method for calculating energy losses so that maximum permissible chain velocity could be determined if required. No experimental evidence was submitted, nor was any design formula proposed.

This paper describes the dynamic loads sustained by a power chain when running at high speeds. Conditions for least destructive fatigue loading are set forth and a formula for optimum chain speed is derived. Dynamic load tests on silent chain are reported in which the loading was measured by means of a special strain gage of the author's design. The tests prove the loading postulated in the first part of the paper, and the conclusions indicate a new approach to chain-drive layouts for power transmission.

Process Industries

The Manufacture of Small Ice, by Crosby Field, Fellow ASME, President, Flakice Corporation, Brooklyn, N. Y. 1950 ASME Annual Meeting paper No. 50—A-5 (in type; to be published in Trans. ASME).

SMALL ice may be defined as water frozen in the form of ribbons, strips, fragments, cubes, or relatively small pieces, whether regular or irregular in shape, or pieces compounded thereof, or compounded of crushed ice. With the exception of ice cubes frozen in the domestic electric or gas refrigerator, it is only at the beginning of its third decade of successful commercialization. The daily production of small ice is now a substantial tonnage, a growth from less than 10 tons per day at the time of the visit of

the Metropolitan New York Section of the American Society of Refrigerating Engineers to the author's first commercial plant in 1928. Although the reasons for this growth will be mentioned briefly, this paper is limited to an abbreviated description of the numerous developments of processes and machinery for freezing small ice, including those in commercial operation today. No mention will be made of the equally numerous methods of freezing large cakes of ice and then crushing, sawing, or grid or wire-melting them into small ice, the product of which has not been included in the production stated.

Wood Technology

Improved Coated Abrasives for the Woodworking Industry, by E. E. Cathout, Behr-Manning Corporation, Troy, N. Y. 1950 ASME Annual Meeting paper No. **50—A-110** (mimeographed).

ONE of the first major changes in the manufacture of coated abrasives or sandpaper was the application of the "Openkote" principle of coating grain on paper, cloth, or combined paper and cloth or fiber. This method provides the space between grains required as chip clearance for the accumulation of the normal residue or waste caused by sanding, thus leaving the grain exposed and free for further cutting.

Sanding costs in furniture plants have been considerably reduced by the substitution of paper-backed coated abrasives for the more expensive cloth-backed type formerly used.

The several types of cloth used in the manufacture of coated abrasives have undergone many changes in recent years, both as to the construction and the processing prior to coating. These materials generally known as drills, jeans, finishing cloth, and sheeting are all purchased as grey goods and require finishing to technical specifications before they can be used in the manufacture of coated abrasives.

These finishing operations consist, in general, of bleaching, shrinking, dyeing, and filling both the front and the back side of the cloth all to predetermined technical specifications.

The garnet grain used in the manufacture of coated abrasives is the same mineral used in exquisite jewelry. It is ideally suited to the manufacture of sandpaper because of its inherent sharpness and normal type of elongated fracture under pressure.

The artificial minerals, aluminum oxide and silicon carbide, man-made in electric furnaces for use as abrading agents, have been constantly improved since they became available in commercial quantities during the early part of the twentieth century.

During recent years the grading of all minerals used by the abrasive industry has been constantly studied. The importance of close particle tolerances has been recognized as essential to modern finish requirements, and coated abrasives are now manufactured in particle-size ranges that are considered to be negligible.

The greatest single improvement in the manufacture of coated abrasives during the past several years would appear to be the perfection of the electrostatic method of coating the grain on the backing. By this patented process, it is possible to control the position of each abrasive grain together with the orientation or distribution of the entire mass of grain making up the surface of the coated abrasive item.

Experiments proved the feasibility of using certain types of resins as adhesives, because they held all the necessary qualities required, namely, bonding strength, resistance to heat, and flexibility. Today "durabonded" resin, and combination glue and resin bond abrasives are available with productive qualities that continue to amaze both the manufacturer and the user. They are the ideal cutting tool for use on the high-speed sanding equipment being built by machine manufacturers for increased production.

Evaluation of Carbide Tools in the Woodworking Industry, by R. D. Brooks, Firth Sterling Steel & Carbide Corporation, McKeesport, Pa. 1950 ASME Annual Meeting paper No. **50—A-108** (mimeographed).

THIS paper presents a yardstick by which carbide tools are judged by the user, Increased production, improved quality cuts, and decreased costs are the ultimate measures of value. The responsibilities of four groups—the carbide producers, the tool fabricators, the machine manufacturer, and the user—are outlined. The woodworking industry has also been cautioned against considering carbide a cure-all for all production ills. The existing confusion and misunderstanding with regard to the use of carbide tools within the woodworking industry is not unusual. Such confusion and misunderstandings exist in every industry when new materials or processes are introduced. This confusion will continue until co-ordination of the responsible groups make it possible to obtain reliable records of carbide-tool performance in volume great enough to be statistically acceptable.

The value of a material or process is established not only by its successes, but also by its failures. However, both successes and failures must be measured under controlled conditions and the results judged by adequately trained and impartial technicians. The resulting data to be usable on an industry-wide scale should be uniformly compiled and made available to all groups or individuals concerned.

Concurrent with the compilation of this data, a start should be made toward developing carbide-tool standards for the woodworking industry. These standards should include or consider materials, applications, machines, and results. Establishment of standards as early as possible always leads to greater efficiency. When accepted standards for materials and processes have become fixed by tradition and custom, changes become more difficult and costly. The current attempt to standardize saw arbors is an example.

ASME Transactions for February, 1951

THE February, 1951, issue of the Transactions of the ASME (available at $1 per copy to ASME members; $1.50 to nonmembers) contains the following:

TECHNICAL PAPERS

Investigation of Turbulent Flow and Heat Transfer in Smooth Tubes, Including the Effects of Variable Fluid Properties, by R. G. Deissler.

New Technique for Obtaining Heat-Transfer Parameters of the Wall and Combustion Gas in a Rocket Motor, by M. E. Ellion.

Photographic Study of Surface-Boiling Heat Transfer to Water With Forced Convection, by F. C. Gunther.

Chemical Removal of Copper From Boilers, by R. G. Call and W. L. Webb. (50—SA-34)

Phosphoric-Acid-Cleaning of Boilers, by T. E. Purcell and S. F. Whirl. (50—SA-44)

Accurate Spring Counterbalancing, by W. S. Rouverol. (50—SA-6)

Displacement Versus Time Characteristics of Hydraulic Actuators, by L. Sigfred Linderoth, Jr. (50—SA-5)

The Design of Nonlinear Leaf Springs, by S. P. Clurman. (50—F-5)

On the Design of Rotor-Coil Support Rings, by J. J. Ryan. (50—F-6)

Development and Testing of Brakes for High-Speed Railroad Equipment, by C. E. Tack. (50—SA-20)

Comparative Strengths of Some Adhesive-Adherend Systems, by N. J. DeLollis, Nancy Rucker, and J. E. Wier. (50—F-15)

Dynamic Shear Properties of Rubberlike Polymers, by I. L. Hopkins. (50—F-24)

Metals for High-Pressure Hydrogenation Plants, by G. A. Nelson. (50—SA-3)

Cyclone-Fired Pressurized Steam Generator, by Merle Newkirk. (50—SA-38)

COMMENTS ON PAPERS

Including Letters From Readers on Miscellaneous Subjects

What Price Speed?

COMMENT BY L. A. COWLES, JR.,[1] AND R. H. WATSON[2]

The following information may be of value in supplementing the data provided on the subject of power requirements for propulsion of vehicles.[3]

Specific power values for diverse self-propelled vehicles were computed by the writers. Data for crawler tractors and draglines, the latter being among the slowest of all self-propelled equipment, were plotted in groups which represent exponential equations. The exponents are presumed to vary as designers' or perhaps sales managers' choices. Approximate mean values for draglines were specific power 3.5 at 1.2 mph and for tractors specific power 8 at 6 mph.

Curves were drawn for several types of boats in use on rivers. Still-water speeds were necessarily used, which is of course slightly inaccurate. Weights used were long tons.

Specific power for short work push-boats without tows at 6 to 11 miles per hour plotted vertically downward from points above the author's curve for pedestrians. As tows were added, the speeds decreased until the lower part of the curve was parallel to the authors' submerged submarine curve but about 5 mph slower. These low speeds were probably further reduced by operation in channels of less than, or near, critical depths. No tow exceeded 200 ft in length.

Well-designed commercial pushboat tows within the range for which data were available showed a very slight drop in speed from 6 mph as the specific power was decreased from 0.3 to nearly 0.15 by increasing loads and tow lengths. Curves for these boats probably represent the upper part of curves similar to that for the submerged submarines, hence predictions that the extension of the curves would cross the limit that the authors have found for single vehicles might not be warranted.

None of the foregoing boat data showed significant influence of types of hulls, power, or propulsion methods. Rake-type and modeled-bow hulls powered variously by gasoline, Diesel, or steam engines were included. Propulsion methods were single and twin-screw propellers, radial side wheels, and both radial and feathering stern wheels. The favorable influence of tow length is present in some of the data. Length of tows is limited by channel widths and bends, and by maneuverability. Trains of articulated self-powered barges could conceivably be lengthened almost indefinitely in so far as structural considerations alone govern. Maneuverability and control of such a train is another matter.

Data from a single trip of a half legendary early-day Missouri River packet boat were plotted as a point on the merchant-ship curve. The loaded draft of this boat was 6 in., indicating negligible pay-load. These data are questionable and in any event the boat was very uneconomical. This illustration is given only because it so well bears out the authors' contention that certain types of vehicles are inefficient means of transportation outside certain limited ranges of speed.

AUTHORS' CLOSURE

We believe that the comments of Messrs. Cowles and Watson constitute a valuable contribution to the question raised in our paper. We are very pleased that our analysis inspired work in a special field for which we did not have sufficient information.

We appreciate the contribution of the writers and hope that further material will be contributed to a problem having fundamental importance in the design of vehicles.

TH. VON KÁRMÁN.[4]
GIUSEPPE GABRIELLI.[5]

[1] Mechanical Engineer, U. S. Engineers Office, Kansas City, Mo. Jun. ASME.

[2] Mechanical Engineer, U. S. Engineers Office, Kansas City, Mo. Member ASME.

[3] "What Price Speed—Specific Power Required for Propulsion of Vehicles," by G. Gabrielli and Th. von Kármán, MECHANICAL ENGINEERING, vol. 72, October, 1950, pp. 775–781.

[4] Honorary Professor, Columbia University; Chairman of Scientific Advisory Board of the USAF; Consultant of the Aerojet Engineering Corporation, Azusa, Calif.; ASME Medalist; 1941. Mem. ASME.

[5] Director of Engineering, Fiat Company. Professor, Politerico, Torino, Italy. Mem. ASME.

Correlation of Solids Content in Gas

COMMENT BY R. B. ENGDAHL[6]

The instantaneous determination of the weights of solid material in a gas stream is an objective very much to be desired in work on air pollution. The author[7] has made a good step in that direction. It is disappointing but not completely unexpected that the author concludes that the nature of solid constituents, whether ash or smoke, needs to be known before the results can be given by this instrument in terms of the weight of material. It is probable that this is principally a question of the relative size of the two types of material.

This result is confirmed by many tests made on boiler-plant stacks where there is no smoke but considerable quantities of stack dust. The dust-loading was of the same order as shown in Figs. 7 and 8 of the paper, in the neighborhood of 1 grain per cu ft. Under these conditions a photoelectric meter, carefully checked for zero on clean air, gave no appreciable indication of light absorption by the ash-laden gas. The reason for this is apparently that these pieces of ash are comparatively large in terms of the particles usually known as smoke, hence, although the weight-loading is high, these pieces transport considerable weight across the light beam in such concentrated form that the effect on the beam is small. If they were finely pulverized and dispersed, the effect probably would be entirely different.

Thus, in the determination instantane-

[6] Supervisor, Battelle Memorial Institute, Columbus, Ohio. Mem. ASME.

[7] "Smoke-Density Measurement," by W. F. Stoecker, MECHANICAL ENGINEERING, vol. 72, October, 1950, pp. 793–798.

ously of dust-loading, we have a will-o'-the-wisp, for it has now been shown that we can determine solid pollution quickly by means of this simple instrument, if we know the nature and characteristics of the material passing. Unfortunately, in most processes this factor varies from minute to minute, and we now need another instrument to provide this information instantaneously. This next step is a much more difficult task. However, the rewards will be great. The determination of solid-loading in gases is now an exacting task and takes considerable time by skilled workers, most often under very difficult working conditions. An instantaneous method for getting the entire answer at once would save tremendous amounts of time and money.

COMMENT BY W. T. SPROULL[8]

No mention is made in the paper regarding the possibility of smoke adhering to the windows where the light beam enters and leaves the smoke pipe, except that Fig. 3 carries the notation "1/8-in. gap to prevent discoloration of light and photocell." It is assumed that the two gaps shown in the figure allow external air to leak into the 2-in. pipe supporting the light and cell so as to sweep any smoke in these pipes back into the 6-in. smoke pipe. Even with this precaution, it would be advisable for the operator to wipe or clean the lamp and photocell frequently to prevent false absorption of light by smudged windows being misinterpreted as absorption by smoke in the pipe.

The author evidently assumes that the photocell current is proportional to the intensity of the light striking the cell. When he is speaking of a ratio of 70 to 100 this is a very good assumption. However, he is there dealing with a smoke-loading of 0.55 grains per cu ft. For high loadings, above 2 grains per cu ft, the light-intensity ratio approaches 10 to 1 (see Fig. 6). In such cases, the assumption that the current is proportional to the light intensity is not very safe. For wide variations in light intensity, it would be better to arrange an optical system so that a device resembling an iris diaphragm-and-lens combination could be inserted in the light beam to cut off a known fraction of the light. Then it could be adjusted so the photocurrent with no smoke is, say, 5 microamp. With smoke present, the diaphragm would be opened sufficiently so as to bring the current again to the value 5 microamp. If this involved a ratio of 20 to 1 in the diaphragm settings, then the ratio of light intensities would be 20 to 1. It would of course be essential to continue the present system of zero-point checks during a test, to eliminate errors due to minor fluctuations in the brightness of the lamp.

It is also essential to keep the temperature of the photocell fairly constant. Since it is close to the flue, it should be protected from radiant heat by placing it in a constant-temperature chamber.

The foregoing precautions are based upon some similar work conducted by the writer. In this work, a device was built and tested for use in passenger airplanes. It used photocells to detect smoke in the passenger and baggage compartments. If several passengers were smoking, the smoke density was not sufficient to cause any action. But, if a fire broke out, the smoke density supposedly would reach a value somewhat greater than the density due to tobacco smoke. In this case, the device tripped a fire alarm. In order to make the device dependable, it had to be constructed so that the light intensity at the cell did not vary over a large ratio, and a null arrangement is therefore necessary. It was also necessary to keep the temperature of the photocells within a range not exceeding about 5 deg F.

[8] Acting Director of Research, Western Precipitation Corporation, Los Angeles, Calif.

AUTHOR'S CLOSURE

As Mr. Engdahl points out, the effect of particle size on the light absorption now presents a limitation on the photoelectric method. This problem will have to be surmounted in order for correlations determined in one installation to apply to another. While the composition of the solids may affect the light absorption of particles of the size dealt with in these tests, Tyndall found that in the submicron range the type of material had little influence.

Mr. Sproull mentions the necessity of keeping the temperature of the photocell constant. This is true particularly when the external resistance of the circuit is high. The effect of ambient temperature on the photocell output is reduced, however, by keeping the external resistance low.

Although not mentioned in the paper, smoke adhering to the windows of the light and photocell was accounted for by taking an average of the readings with a clean stack at the beginning and end of each test. This average was then used in the computation of per cent light absorption.

WILBERT F. STOECKER.[9]

[9] Instructor in Mechanical Engineering, University of Illinois, Urbana, Ill. Jun. ASME.

Styling the Machine Tool

COMMENT BY E. K. HENRIKSEN[10]

There are limitations to the "block form," mentioned in the paper.[11] It is usually very pleasing and harmonious to the eye if the base is somewhat longer than the height; also the square is usually satisfactory, and even a rectangular block, somewhat higher than it is wide, still looks stable and well proportioned. But if the height exceeds the width to any significant amount, the eye will get the feeling that the design is top heavy. The remedy is to reduce the width at the top; in other words to use a truncated pyramid.

The objections to spherical corners are economical only; the writer is inclined to believe that the spherical corner is more pleasing to the eye than the "cylindrical" corner. Therefore, it may be in order to point out that die costs can be kept within reasonable limits by using a few standardized radii only.

Large flat surfaces may, as mentioned by the authors, present a problem from the styling point of view, and it is suggested to utilize an elevated cover or the like. The writer would like to emphasize another viewpoint: An opening, and particularly a large opening, in a surface constitutes a weakness in the whole design. Large unbroken surfaces, and particularly unbroken symmetrical walls, add to strength and rigidity, and should be appreciated from this point of view by the "strength-minded" customer. Consequently, unbroken surfaces should be preferred, not avoided, and a more pleasing appearance may be obtained, if necessary, by giving them a slight curvature (which, incidentally, sometimes will add considerably to strength and rigidity).

It is common, and useful, to use an elevated band or a projecting edge or a shallow rib, or the like, where castings meet and have to match. However, this principle should be applied with caution and, where a casting has no matching part in the same plane, it should not be used at all. The authors' Fig. 8, shows an electronic gaging instrument, having a column rising over a

[10] College of Engineering, Cornell University, Ithaca, N. Y. Mem. ASME.

[11] "Styling the Machine Tool," by Frank Burgess and Harold Sizer, MECHANICAL ENGINEERING, vol. 72, October, 1950, pp. 783–786.

bedplate. The diameter of the column is increasing toward the base, and the lower face of the column is further accentuated by the presence of a wide band. This design makes the eye expect a rigid joint between column and base plate, (see Fig. 1, herewith), but instead of this, it meets only a comparatively slim stem, the contrast in diameter being further exaggerated by the presence of the wide band on the lower end of the casting.

The result is an impression of shakiness, which could have been avoided by a slight modification of the lower edge of the column casting.

COMMENT BY R. M. SCOTT[12]

For over 20 years, the writer has worked on the design of industrial equipment. This work has been confined to machinery for the wire industry rather than the machine-tool industry.

The first purpose of any machine in whatever field it is to be used is the same. That purpose is "function" as brought out in the paper under discussion.

The writer has always tried to follow three rules in the design of wire machinery, these are:

1 To make the machine functional.

2 To make for ease of operation and to make less duties for the operator to perform.

3 Then to make the machine a thing of beauty, if possible, provided this can be done without detriment to either of the first two items.

Much can be done and has been done to improve the appearance of industrial machinery. Smooth lines and flat surfaces which can be easily cleaned tend to improve the appearance.

The rules as set forth by the authors apply to the design of machinery for any industry. If we follow these and add to them from our own experience we will produce machines which are not only functional but also objects which are pleasing to the eye.

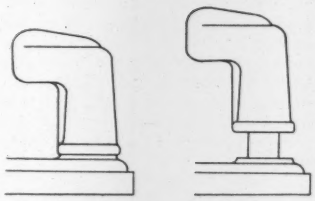


FIG. 1 COLUMN DESIGN

AUTHORS' CLOSURE

It was not the intention of the authors in the original paper to establish any hard and fast rules concerning appearance design. There is little theory involved in its execution. Esthetics is a philosophy open to much controversy, subject to individual judgment.

Mr. Henriksen has recognized and cited the limitations to the block form. Fig. 2 of this closure shows an imaginary grinding-machine pedestal which may be functionally right, but because it is much higher than it is wide it appears unstable. However, the truncated pyramid is not the only solution. Fig. 3 is an example of what the stylist might do to alleviate the stilted effect, without any marked departure from the basic block form.

There are certain visual phenomena with which many of us are familiar, particularly the industrial designer. Fig. 3 is a study in which some of these famil-

[12] Sales Engineer, Wire Division, Morgan Construction Company, Worcester, Mass. Mem. ASME.

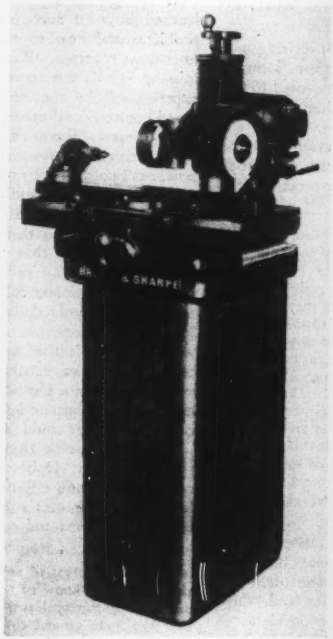


FIG. 2

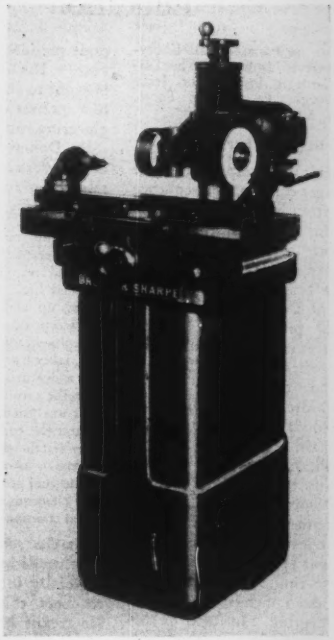


FIG. 3

iar optical illusions are utilized. The integrally cast, embossed band, extending vertically down the front of the grinding-machine pedestal, accents the vertical dimension, tending to make the upper portion look narrow. It then merges into the wide horizontal band extending completely around the bottom, providing the desired illusion of width at its base. Yet, over-all dimensions of both pedestals, Figs. 2 and 3, are almost identical. Fig. 3 also serves to illustrate a simple method of circumventing the unavoidable irregularities and wavy surfaces that appear in expansive cast areas. Curvilinear surfaces may be used effectively but introduce more expensive patterns or dies for metal fabrication.

The writer would like to clarify another point where some misunderstanding may have been conveyed. It was not implied in the original article that false openings and covers should be used to lend more character to an otherwise too-smooth monotonous design, and it is agreed that unnecessary openings may present a serious weakening of structure.

A likeness of a cover in the form of an integral raised panel might be used without any actual opening or break in the wall.

Mr. Henriksen's criticism concerning the electric gaging instrument is entirely correct. The use of an accordion-type rubber boot would no doubt help the condition of which he writes. However, since the instrument is more often used for the measurement of small parts, the spindly appearance is usually nonexistent. The band which extends down the front and around the base of the column is not merely decorative; it is functional in that it provides a channel to enclose the electrical power-supply cable to the gaging unit within the measuring head.

The interest of E. K. Henriksen and R. M. Scott is very much appreciated and their comments accepted with sincere respect.

FRANK H. BURGESS.[13]
HAROLD SIZER.[14]

[13] Industrial Designer, Brown & Sharpe Mfg. Co., Providence, R. I.
[14] Director of Design, Brown & Sharpe Mfg. Co., Providence, R. I. Mem. ASME.

REVIEWS OF BOOKS

And Notes on Books Received in the Engineering Societies Library

The Development of Professional Education

THE DEVELOPMENT OF PROFESSIONAL EDUCATION. By Robert E. Doherty. The Carnegie Press, Carnegie Institute of Technology, Pittsburgh, Pa., 1950. Paper, 6 × 9 in., 58 pp., bibliography, $1.

REVIEWED BY JAMES KIP FINCH[1]

THIS is a memorial pamphlet of some fifty-odd pages containing a sequence of quotations from various papers and addresses by the late president of the Carnegie Institute of Technology. The sections have been most carefully selected to develop in a brief but most effective manner President Doherty's educational philosophy and proposals for action. Here is an engineer of wide industrial and educational experience setting forth in stimulating and compelling English basic truths regarding engineering education which explode in one's mind and open up new chain reactions.

President Doherty joined the General Electric Company following his graduation from the University of Illinois in 1909. He remained with GE as design and later consulting engineer until 1931 when he was appointed professor of electrical engineering at Yale and, the following year, dean of the newly created school of engineering. In 1936 he became president of Carnegie, retiring last year. His death this past summer brought to an end a career devoted to the best interest of his profession and of engineering education.

Dr. Doherty sees in education the hope of the Western world for continued progress—even for survival—especially professional education.

"In this task professional education has especial responsibility. For by and large professional people determine the character of national life. Whatever the quality of their leadership, and whether or not they recognize and accept it, they are the leaders—the lawyers, physicians, engineers, businessmen, clergymen, labor leaders, etc. What our professional men and women accomplish depends, of course, upon the nature and extent of their knowledge, their analytical and creative power to apply it, and the ends to which it is applied. . . . They set the pattern of national life and that pattern is cast in the mold of their earlier intellectual and moral experience. . . .a dominant element in that experience is their professional training."

At the same time Dr. Doherty feels that traditional educational methods, especially in engineering, too often fail to meet this challenge to leadership. He recalls his own earlier problems of adjustment and inner struggles when, as a young graduate, he began his work under Dr. Steinmetz at Schenectady. "I had learned technical-book knowledge well enough to reproduce it; I had learned how to solve special types of problems and how to carry out certain important routines. But something was missing." "There is one educational experience," he continues, "which has stood out above all others in forming my point of view. It was the gradual release and cultivation of such latent mental power as I possessed, by my being exposed repeatedly to the discipline of Steinmetz's mind. Within my limits, he taught me how to think. Experience has demonstrated that a trained mind will make its way in new situations, even if the particular subject matter and techniques involved have not been learned in college. . . .The simple fact was, I had not learned to analyse a situation in terms of general principles. I was looking for a formula and there was no formula; a general principle or concept was all that could help me."

It is emphasis on thinking from principles that Dr. Doherty would advocate—not only in engineering educaton but in the engineer's approach to the broader problems and responsibilities of his profession.

"The most pervasive and insidious educational fallacy I know of is that education is achieved by merely learning subject matter; that the more ground covered in class—the more pages assigned in the book—the greater the education. And what is equally bad and

[1] Renwick Professor of Civil Engineering, Columbia University, New York, N. Y.

makes educational reform almost impossible is the corollary that the way to improve education is merely to change subject matters in the curriculum. This theory overlooks the fact that the ability to think straight and constructively has to be learned by actually doing such thinking. The ability to think does not simply come when subject matter is learned, nor is it absorbed by merely listening to a teacher. It is won by struggle."

The crucial question in engineering education as Dr. Doherty sees it is therefore: Shall emphasis be placed on thinking or on subject matter and techniques? He recognizes the basic difficulty in the fact that much of the time allotted to engineering education must be devoted to getting ready—to mastering the fundamentals, accumulating the tools basic to professional analysis and thought. But, "If one spends too many years in merely getting ready," he remarks, "his mind becomes regimented; freedom of thought disappears; the creative spark is extinguished."

This problem is, of course, not new to educators; it is one that the conscientious engineering teacher has struggled with for years—and, too often, succumbed to the far less exacting, far more certain and comfortable task of simply imparting standardized routine information. But it is also a problem of increasing importance both because we seem to have accepted the notion that education is merely the accumulation of knowledge and because the trend in undergraduate engineering education is unquestionably toward putting off the utilization of knowledge until later—either in graduate work or through apprenticeship. The first engineering degree is in process of becoming merely a getting-ready degree.

Dr. Doherty does not profess to have found a cure. He does, however, offer some suggestions. Quoting the statement of the late Professor A. N. Whitehead of Cambridge and Harvard: "Education is the acquisition of the art of the utilization of knowledge. An art very difficult to impart," he insists that the development of thinking power should be on an equal footing with the development of knowledge and manipulative techniques.

He would emphasize the application of fundamental principles in the analysis of problems—What principles govern? What simplifying assumptions must be made? What accuracy is required? What conditions must be satisfied? The solution then follows and this must in turn be appraised in the light of the assumptions. He would emphasize particularly "purposeful and thoughtful writing." "Composing component thoughts into a logical organic whole is a powerful mental discipline."

One gathers the impression that Dr. Doherty would advocate a return, at least in part, to the so-called case system of instruction which has become standard in law schools where reasoning from principles (and precedents!) is emphasized. In earlier days, before engineering had been "reduced to a science," engineering education was in large measure based on examples from practice. Too frequently, to be sure, the instruction was largely descriptive rather than analytical in character; was devoted to "how" rather than "why." Nevertheless the modern textbook trend has, perhaps, carried us too far in the other direction. We badly need some new engineering texts which will deal with all aspects of problems drawn from practice and would furnish some of the ammunition needed for the thought-provoking analytical studies which Dr. Doherty advocates.

The latter part of this pamphlet deals with the oft-debated problem of the engineer's social responsibilities. "I am not one," Dr. Doherty states, "who says it is the engineer's mission to save the country, but I am one who says that if it is to be saved, he must have a very definite hand in it. . . .And he must therefore have an opportunity while in college to begin his educational preparation for this responsibility." "It is hopeless," he remarks, "to try and influence, by and large, those now constituting the professions: it is too late. They have, most of them, already formed the views and habits which will guide their professional lives, and these cannot be changed through exhortation. The time to cultivate a new point of view is during the formative years of professional education."

The importance of this problem is emphasized in the statement:

"Let me suggest that the hope that the comparative freedom of the American people may endure does not lie alone in such things as freedom of speech and the press, congressional debates, and popular suffrage; these are merely the manifestations of such freedom. It lies in the ultimate attainment in public affairs of scholarly and professional thought, pursued under the discipline of the scientific spirit, and motivated by a philosophy of public good."

It is idle, he observes, to talk about social responsibilities. There is very little prospect of getting the engineer interested by talk. Dr. Doherty offers no sure cure, but he does express the thought that "active interest will follow competence" and "whether the interest exists beforehand or is created, it is nevertheless cultivated in college and this cultivation profoundly influences the direction of later activity."

A number of the ideas raised in the first part of this collection of extracts are discussed more fully in the latter pages—Education in Values, The Educational Task—of a pamphlet that clearly reveals the inspiring mind of a leader in engineering education.

Man the Maker

MAN THE MAKER: A History of Technology and Engineering. By R. J. Forbes. Henry Schuman, Inc., New York, N. Y., 1950. Cloth, $5^1/_4 \times 8^1/_2$ in., 41 plates, illus., bibliography, index, 355 pp., $4.

REVIEWED BY E. F. CHURCH, JR.[2]

THIS book is the result of an effort to show, in the limited confines of a small volume, "how certain of our material achievements arose and became a part of that complex of culture traits we call civilization," and how "the engineering and technology of the present is nothing more than the accumulated heritage of the past, the combined experiments and technical creations of hundreds of generations."

The author has divided the history of technology and engineering into nine periods, some of them overlapping chronologically, as follows: The Dawn of History (before 3000 B. C.), The Great Empires of the Ancient Near East (3000–600 B.C.), Greeks and Romans (600 B.C.–A.D. 400), Wardens of the Classical Heritage (Arabian Domination, A. D. 600–1200), Technology and Theology (Middle Ages, 400–1500), New Wine Into Old Bottles (Renaissance, 1500–1750), Steam Comes of Age (Industrial Revolution, 1750–1830), The Conquest of Distance (1750–1930), Steel and Electricity (1830–1930). Since a satisfactorily complete history would obviously require many volumes, the author has restricted himself, in each of these periods, to the treatment of some of such essential topics as tools, metallurgy, textiles, glass, chemical technology, power sources, transportation (roads, railroads, ships, airplanes), communication (writing, printing, paper, electric transmission), water supply, bridges, and some other aspects of civil engineering.

The text is full of interesting informa-

[2] Professor Emeritus of Mechanical Engineering, Elmira, N. Y. Mem. ASME.

tion and moves rapidly, except perhaps in the last few chapters dealing with the great multitude of modern accomplishments. The space given to each topic is so limited that one will often wish for a more extended treatment. The author intends this desire to be met by the bibliography, in which items are classified in accordance with the chapter subject matter, and leaving to the reader the choice of books giving more elaborate or specialized treatment. Some interesting statements are: Windmills were originally developed in the Far East, were later adopted in the West and have now practically disappeared in the East; the library at Cordoba had 600,000 volumes in the year 900; cast iron, when accidentally produced in early metallurgical operations, was discarded as useless because of lack of knowledge of a suitable technique; in the Middle Ages the goal of civilization was the Kingdom of Heaven rather than the conquest of nature, and science was not the handmaiden of philosophy, rather both were forced to serve religion; and the first man to declare that it was the duty of natural science to harness the forces of nature for the benefit of mankind was Francis Bacon, 1561–1626.

Study of such a book as this will soon disabuse one of any idea he may have had that one nation has or has had a monopoly of discovery and invention In a particular age one national group may seem "to hold the key to knowledge, but at close inspection this will prove to be a surface impression only." "Knowledge is something that cannot be monopolized, for if kept secret it is useless, and if disseminated it will inspire others to spread it in ever-widening circles." Mass production is widely thought to be an American invention or at least an American development, but the author shows that it appeared much earlier in Europe, and arose there, as here, from the military needs for firearms and artillery. In fact, a large portion of the development of technology in the world has arisen from the demands of offensive and defensive warfare. The effects on technological developments of national philosophy, religion, and ideals vary from period to period, and among different nations.

The author has given dates for a large number of important discoveries and inventions; they are not always consistent with statements in the text. In the latter part of the book, the efforts of the author to give credit wherever due leads to the insertion of so many dates that the text is rather heavily loaded. Presumably the author's authority for each of these dates is in one or more of the references listed in the bibliography, but he hardly ever names his authority. As there are some obvious errors, the reader's confidence in the dates becomes impaired. Valuable as it is in many respects, it is doubtful if the book can be accepted as a reliable authority.

Some names are incorrect, as "Samuel" for Samuel Slater, operator of the first textile mill in the U. S.; "John Walker" for John Barber who took out a patent on a gas turbine at an early date. Some statements appear worth looking into, as: F. W. Taylor introduced belt drives in 1893; . . . in 1919 . . . the Alcock-Brown flight in the far-famed NC4; in 1835 the British Navy had over 1300 steam vessels; coal . . . of the anthracite type was better suited for the manufacture of metallurgical coke; . . . iron filings and sal ammoniac to serve as packing between the piston and the cylinder; an early sixteenth-century blast furnace was 30 feet high and 24 *feet* diameter; in the time of the Romans, ships of 3000 tons were occasionally built. An impulse turbine is described, but is called a reaction turbine. There are also numerous examples of repetition, omission, transposition of letters and words, and misspelling.

The author has evidently put an enormous amount of time into the book, has done a good job in the selection and organization of his material, and has made the book attractive, easy to read, and highly informative. More careful writing, checking, and proofreading would have helped to make it of decided value in engineering literature.

Books Received in Library

ASTM STANDARDS ON TEXTILE MATERIALS, prepared by ASTM Committee D-13; Specifications, Tolerances, Methods of Testing, Definitions and Terms, October, 1950. American Society for Testing Materials, Philadelphia, Pa. Paper, 6 × 9 in., 572 pp., illus., diagrams, charts, tables, $4.50. The 1950 edition of this compilation includes in their latest form ninety specifications, test methods, and tolerances developed by the ASTM Committee on textile materials. A wide range of subject matter is provided relating to asbestos, bast and leaf fibers, cotton, glass textiles, hosiery, rayon and silk, and wool. Appendixes include the basic properties of fibers, a psychrometric table, a yarn number conversion table, and several proposed test methods and recommended practices.

AIRPLANE DESIGN MANUAL. By F. K. Teichmann. Third edition. Pitman Publishing Corporation, New York, N. Y.; Toronto, Canada; London, England, 1950. Cloth, 6 × 9¼ in., 382 pp., diagrams, charts, tables, $7.50. Written for the student, young engineer, and draftsman, this book outlines an orderly procedure for the design of airplanes. It considers airfoil selection, preliminary weight estimation, the balance diagram, the various parts of the plane, instruments, and equipment, preliminary performance calculations, elementary longitudinal-stability calculations, and materials of construction. The appendix contains much valuable data. The edition has been revised and the bibliography omitted.

CLASSICAL MECHANICS. By H. C. Corben and P. Stehle. John Wiley & Sons, Inc., New York, N. Y.; Chapman & Hall, Ltd., London, England, 1950. Cloth, 5⅛ × 8¾ in., 388 pp., diagrams, tables, $6.50. The underlying assumptions of classical mechanics are presented in a manner intended to smooth the transition to quantum and relativistic mechanics. It includes the following topics not usually covered in books on mechanics: The problem of central motion; the theory of real linear vector spaces as applied to problems of oscillations, etc.; the transformation theory of dynamics; Hamiltonian mechanics; Poisson brackets, and so on. Relativistic mechanics is applied to the motion of ions in high-energy accelerators.

CRUDE OILS, Chemical and Physical Properties. (Science of Petroleum, volume V, part 1.) Edited by B. T. Brooks and A. E. Dunstan. Oxford University Press, London, England; New York, N. Y.; Toronto, Canada, 1950. Cloth, 8¼ × 11¼ in., 200 pp., illus., diagrams, charts, tables, $11. Supplementing the four-volume reference work, "Science of Petroleum," this is the first part of a series dealing with the chemistry, physics, and chemical engineering of petroleum. It covers the crude oils of various parts of the world, an evaluation of crude oil and oil stocks, economic developments in the industry, and the chemical and physical properties of petroleum hydrocarbons.

DAVISON'S KNIT GOODS TRADE, 60th Annual, pocket edition, October, 1950. Davison Publishing Company, Ridgewood, N. J. Fabrikoid, 5 × 8 in., 904 pp., illus., $5.50. The 60th annual edition of this register and directory of all knit-goods manufacturers in the United States and Canada provides the usual geographical, alphabetical, and product listings. Dyers and finishers, factors, agents, wholesalers, chain stores, and retailers are also listed. Knitting-yarn spinners and dealers, raw and thrown silk, rayon, nylon, and other synthetic fibers and yarns, and elastic-yarn firms are among the other categories included. Special sections are devoted to a buyer's guide, to knitting machinery and supplies, and to brands and trade names.

ELEKTRISCHE HEIZEINRICHTUNGEN für Industrie und Gewerbe. By W. Schulz. Third edition. W. Schulz Selbstverlag, Frankfurt A.M., Ginnheim, Germany, 1950. Paper, 6 × 8¼ in., 163 pp., illus., diagrams, charts, tables, 6.40 Dm. Electric heating equipment for a wide variety of industrial purposes is briefly described, covering a range from small resistance elements to large drying ovens. Condensed information on fundamentals, calculations, and control devices is also included.

EXPERIMENTELLE UNTERSUCHUNG DER SPANNUNGSVERTEILUNG IN PLATTEN VON STREIFENFUNDAMENTEN. THEORETISCHE UNTERSUCHUNGEN ÜBER DIE DURCHBIEGUNG PARALLELOGRAMMFORMIGER PLATTEN UNTER ZENTRISCHER EINZELLAST. (Publications du Laboratoire de Photoélasticité École Polytechnique Fédérale, Zurich, Switzerland, No.4.) By G. Herrmann. Éditions Leeman, Zurich, Switzerland, 1950. Paper 6 × 8 ¾ in., 127 pp., diagrams, charts,

tables, 13.50 Sw. frs. This book considers both the experimental and theoretical aspects of a recent study of plates. The experimental aspects deal with a study of stress distribution in plates by means of segments. The theoretical studies are focused on the buckling of parallelogram types of plates under a single centered load. Numerous diagrams and tables are included.

THE NOMOGRAM. By H. J. Allcock and J. R. Jones, revised by J. G. L. Michel. Fourth edition. Pitman Publishing Corporation, New York, N. Y.; Toronto, Canada; London, England, 1950. Cloth $5^1/_2 \times 8^3/_4$ in., 238 pp., diagrams, charts, tables, $3.75. This book combines a discussion of the general mathematical theory of computation charts with practical directions for their construction and use. Details of construction are emphasized, and examples are given illustrating the various methods employed. In this edition a new chapter considers the connection between intersection and alignment nomograms, and a new appendix deals with the formation of the basic determinant for nomograms of the third class.

OPERATIONAL CALCULUS Based on the Two-Sided Laplace Integral. By B. Van der Pol and H. Bremmer. Cambridge University Press, American Branch, New York, N. Y., 1950. Linen, $6^1/_4 \times 10$ in., 415 pp., diagrams, charts, tables, $10. Written for engineers and mathematicians, this book applies operational calculus in its modern form to mathematics, physics, and technical problems. It provides the basic principles, ideas, and theorems as well as many worked-out problems. Its purely mathematical treatment is more advanced than is usually found in books devoted to practical applications. The subject is treated by means of the bilateral or two-sided Laplace integral rather than by the usual one-sided Laplace integral. Rules, relations, and the various kinds of functions treated are presented in condensed form in an appendix.

PHYSICAL PROPERTIES OF GLASS. (Monographs on the Physics and Chemistry of Materials.) By J. E. Stanworth. Oxford University Press, New York, N. Y.; Clarendon Press, Oxford, England, 1950. Cloth, $5^1/_2 \times 8^3/_4$ in., 224 pp., diagrams, charts, tables, $4.75. This monograph describes the advances made in our understanding of the physical properties of glass, with emphasis on those advances which have a bearing on present theories of the structure of inorganic glasses. Part 1 deals with the composition and structure of glasses, Part 2 with the properties in the solid state, and Part 3 with some properties in the liquid state and in the transformation range.

POSITIVE-DISPLACEMENT PUMPS AND FLUID MOTORS. By W. E. Wilson. Pitman Publishing Corporation, New York, N. Y.; Toronto, Canada; London, England, 1950. Linen $6 \times 9^1/_2$ in., 250 pp., illus., diagrams, charts, tables, $7.50. This book is for both graduate engineers entering this field and more experienced men. The first five chapters serve as an introduction and provide definitions, a classification system, an elementary theory of operation, and a test procedure. The last six chapters develop a more nearly complete theory of operations and apply the theory to a method of test-data analysis, to a method of design, and to the discussion of the operation of hydraulic clutches and transmissions.

PROBLEMS IN THE THEORY OF VISCOUS COMPRESSIBLE FLUIDS. By P. A. Lagerstrom, J. D. Cole, and L. Trilling. California Institute of Technology, Pasadena, Calif., March, 1949. Paper, $8^1/_2 \times 10^3/_4$ in., 232 pp., diagrams, charts, $2. This is a progress report which surveys some of the results obtained during the first year of a theoretical investigation of the viscous effects in compressible fluids. It considers the general properties of equations of viscous flow, basic wave phenomena, and boundary-value problems. In this reprinted edition, an errata list, an appendix on flow past a flat plate, and an additional bibliography are added.

PRODUCTION PLANNING AND CONTROL. By T. M. Landy. McGraw-Hill Book Co., Inc., New York, N. Y.; Toronto, Canada; London, England, 1950. Linen, $6^1/_4 \times 9^1/_4$ in., 436 pp., illus., diagrams, charts, tables, $5.50.

Part one of this text deals with the problem of installing and operating a modern production planning and control system. Part two, the largest section, is a declaration of the principles and laws governing the subject, as well as a detailed analysis of the various functions. In part three, supplementary but equally important functions are analyzed and illustrated with case studies. An appendix contains a list of abbreviations and symbols and other reference material.

LES RESSORTS, Étude Complète et Méthode Rapide de Calcul. By C. Reynal. Fifth edition. Dunod, Paris, France, 1950. Paper, $5 \times 7^3/_4$ in., 273 pp., diagrams, charts, tables, 550 fr. This detailed analysis of spring characteristics and spring action covers the following main types: Laminated leaf springs; helical springs of cylindrical, conical, and parabolic form; spiral springs; multiple helical springs; and flat annular springs, such as spring washers. Separate chapters deal with spring action under various conditions, general observations on coil springs, and certain specialized types and adaptations. A slide rule for spring calculations is described in an appendix.

SIMILITUDE IN ENGINEERING. By G. Murphy. Ronald Press Company, New York, N. Y., 1950. Linen, $6 \times 9^1/_4$ in., 302 pp., diagrams, charts, tables, $7. Written on the graduate-engineering level, this book is an organized presentation of the problems of model design and the interpretation of model tests. In the first part the concepts and techniques of dimensional analysis are developed and utilized to develop the principles of design of models. In the second, a rational approach to the design of distorted models and results obtained from them are presented. The third and last is devoted to a study of analogies from the standpoint of model-prototype relationships.

STEAM-PLANT OPERATION. By E. B. Woodruff and H. B. Lammers. Second edition. McGraw-Hill Book Co., Inc., New York, N. Y.; Toronto, Canada; London, England, 1950. Cloth, $6 \times 9^1/_4$ in., 543 pp., illus., diagrams, charts, tables, $7. This book is designed to assist the practical man in securing a working knowledge of the fundamental principles of stationary engineering. In this second edition, new material brings both the description of equipment and the techniques of operation and maintenance up to date. Important changes include new information on welded boiler construction; fuel oil and spreader stokers; technique in the operation and maintenance of boilers, engines, turbines and auxiliaries; and fuel economy. Questions and problems with answers are included at the end of each chapter.

ASME BOILER CODE

General Rules for Selection of Specifications for Ferritic Plates and Tubular Products for Boilers and Pressure Vessels Constructed Under ASME Codes

Completion of a Joint ASME-ASTM Activity

AT the November 3, 1950, meeting of the Boiler Code Committee, approval was given to Case No. 1116 to implement and put into effect for a trial period of one or two years, the General Rules for Selection of Specifications for Ferritic Plates and Tubular Products, approved at previous meetings of the Committee. This introduction is to explain to those in the field of producing steel for boilers and pressure vessels and those who design, fabricate, inspect or operate such equipment, the background and reasons for this action. The Case and the Rules will follow.

In the Power Boiler Code (Section I) and the Unfired Pressure Vessel Code (Section VIII, 1949 and 1950) there are paragraphs dealing with the selection and use of materials identified as in SA or SB specifications published in Section II. Tables of design stresses are published in the Codes for the steel specifications given in Section II.

There are a number of Interpretations or Cases which permit variations in chemistry or physical qualities of certain grades in SA specifications, or new grades not in such specifications. When the Committee receives requests for approval of such changes, they must be referred to a materials subcommittee for approval and to the Subcommittee on Stress Allowances for Ferrous Materials for assignment of design stresses, which may delay the reply several months.

Each year it is necessary for the Committee to consider revisions to ASTM specifications contained in Section II due to action by ASTM. It is also necessary to consider new ASTM specifications not included in Section II but which may be suitable for boiler or pres-

sure vessel construction. All of this requires time and considerable effort. The size of Section II is growing at each re-publication. The 1949 edition has 683 pages and contains 41 SA specifications exclusive of welding electrodes, bolting materials, cast iron and austenitic steels. Some Code states require state publication of this Section.

Case No. 1116 will permit the use of any ASTM specification, Government, or other specification in ASTM form which comes within the limits of the General Rules and complies with their requirements, without reference to the Committee. Material cannot be purchased to the General Rules directly; a specification must be selected. The General Rules establish limits within which the specification requirements must come.

If, after a trial period, this simplification of practice proves satisfactory for plates and tubular products, it is expected that the General Rules will be extended to all ferritic Code materials, such as forgings, castings, and miscellaneous steels. It will then be possible to delete from Section II all SA specifications for ferritic steels.

This joint ASME-ASTM activity was initiated at a conference at ASTM headquarters December 11, 1947. The formation of a Joint Committee consisting of four representatives of the Boiler Code Committee and four representatives of ASTM Committee A-1 was approved to draft the General Rules for plates. After this Joint Committee completed a draft, the same action was taken in regard to tubular products. In each Joint Committee it was required that all actions be unanimous. Both drafts were referred to the appropriate AISI technical committee for approval, which was received. To date ASTM has taken no formal action on the General Rules as drafted by the Joint Committees and approved by the Boiler Code Committee. The Chairman of both Joint Committees was Dr. C. A. Adams.

ASME Code rules which become law in states and cities must be limited to the requirements for safety to life and property. They are not intended as a guide to fabricators or a handbook for construction. A legal safety code is for the protection of the public and not for the convenience of the manufacturer or the steel producer.

ASTM specifications are primarily for the purpose of establishing mutual understanding between producer and purchaser of material. These specifications state certain characteristics and requirements demanded by the purchaser for convenience and economy in fabrication, to insure uniformity of product, and to maintain quality, all of which may be beyond the requirements for safety in use. Tolerances for dimension and weight are largely economic.

The ASME Boiler Code Committee has great confidence in ASTM procedure in publishing steel specifications that may be used with safety in the fabrication of boilers and pressure vessels. It also has confidence in our steel producers in going beyond the requirements of specifications to produce better and better steel.

Experience indicates that very few failures of boiler pressure parts or pressure vessels have been due to the quality of steel, but rather to design, fabrication or operation faults.

Under possible emergency conditions this action will certainly eliminate considerable difficulty.

Perry R. Cassidy, Secretary

CASE NO. 1116

(To Implement Use of Rules for Selecting Specifications for Ferritic Plates and Tubular Products)

Inquiry: General Rules for the Selection of Specifications for Ferritic Plates and Tubular Products have been approved for the construction of boiler pressure parts and pressure vessels under ASME Codes. Until the revisions to paragraphs dealing with the selection of materials and certain limitations to the use and requirements for fabrication of certain SA specifications are made to implement the use of these General Rules, how may they be applied to Code construction?

Reply: The intent of the General Rules is to permit variations in chemical analysis and physical qualities of ferritic plates and tubular products within the limits specified in the General Rules, without the need for approval from the Boiler Code Committee, and to permit the use of new types and grades of material not at present covered by SA specifications, provided such new specifications meet the requirements of these Rules.

As a temporary procedure until the necessary revisions in the Codes are made, the General Rules may be used for selecting specifications for ferritic plates and tubular products under Sections I and VIII, 1949, and Section VIII, 1950, in lieu of SA specifications, under the following requirements:

(1) All requirements as to the use or non-use of a given quality of steel, such as flange or firebox quality, and all restrictions as to the use of a given type of steel, such as Bessemer steel, etc., shall be met.

(2) Where certain grades or types of specification materials are limited in scope by Code rules, and a more liberal scope is permitted for other grades or types, selection of a specification other than an SA specification approved for the more liberal scope, shall require that the quality or type of the new material be equal to that in the comparable SA specification.

For example, Par. P-3(1) permits the use of certain SA specifications for pipe and tubes for boiler pressure parts up to 24 in. diameter. Par. P-3(2) limits the use of other SA specifications to 18 in. diameter. To use an unapproved specification under P-3(1), the requirements of it must be at least as restrictive as for those listed.

(3) Steel which is to be welded under any rules given in the Code shall be of a grade and type equal in weldability to one permitted under those rules.

Where the Code rules require stress-relieving or radiographic or other inspection for certain grades or types of material, or above certain thicknesses for such grades or types, the same requirements must be met for any new specifications not presently listed, when the chemistry of the material corresponds in type to one or more of those which are so restricted.

For qualification under Section IX, a "P" and "O" number in Table Q-5 shall be selected for the new material to match the SA specification type or grade. If there is any doubt about the number to be used, the next highest number, omitting "P" number 2, shall be used.

(4) For carbon and alloy steels containing less than 0.40 per cent molybdenum at temperatures not exceeding 650 F, and for alloy steels containing not less than 0.40 per cent molybdenum with chromium not exceeding 4.00 per cent at temperatures not exceeding 750 F, the design stress may be taken as one-fifth the specified minimum tensile strength for Tables P-5 or P-7 of Section I, and for Tables U-2 or U-4 of Section VIII, 1949, and the design stress may be taken as one-fourth the specified minimum tensile strength for Table UG-23 of Section VIII, 1950.

Above these respective temperatures for carbon and alloy steels, and for alloy steels having over 4.00 per cent chromium, design stresses should be assigned by the Boiler Code Committee.

In the case of welded tubular products, a joint efficiency shall be applied in arriving at design stresses corresponding to that used in the applicable Code table for the method of welding used.

(5) Any specification used under

the General Rules which is not now an SA specification shall be made available to the authorized inspector for approval, and a copy of the specification shall be attached to the required Manufacturers' Data Sheet.

Basic Regulations for Carbon and Alloy Steel Plates

1 *Scope* (a) These rules cover the minimum requirements for the selection of an appropriate specification covering carbon or alloy steel plates to be used in the construction of pressure vessels and boiler pressure parts under the requirements of an ASME Code. Material cannot be purchased to these rules.

(b) Other requirements which may be included in a specification are not considered to involve questions of safety beyond the responsibility of the manufacturer and may be a matter of agreement between the producer and the manufacturer. For the purpose of these rules, "manufacturer" refers to the fabricator of the pressure vessel or pressure part, and "producer" refers to the producer of the steel tube or pipe.

2 *Material* (a) Material specified to ASTM, U. S. Government, or their equivalent* specifications shall be acceptable for use, provided the following applicable requirements are met.

(b) All definitions and testing procedure shall be in accordance with ASTM standards, last issue.

(c) These rules cover steel of firebox, flange, and structural quality. Limitations as to the fabrication, use and design stresses for each quality are included in the rules of the ASME Codes.

The three qualities listed above are defined as follows:

(1) *Firebox quality* plates are intended for application in pressure vessels when exposed to fire or radiant heat where they are subject to thermal and mechanical stresses; for unfired pressure vessels in lieu of flange quality, and for similar purposes.

The raw materials selected for melting and the steel making practices followed are such that the desired steel quality will be produced. Selective ingot or slab preparation together with special surface inspection of the finish rolled plate are requisites of this quality.

Certain chemical limits more restrictive than are acceptable for flange quality may be specified. Two longitudinal tension tests (one top and one bottom), one transverse bend test and one homogeneity test are required representing each plate as rolled.

Special marking is required, consisting of the name or brand of manufacturer, manufacturer's test identification, the quality and minimum tensile strength specified.

Typical Specifications:

Ordinary Firebox quality	ASTM A-285
Carbon-silicon steel firebox quality	ASTM A-201 and A-212

* Similar with respect to essential requirements.

(2) *Flange quality* plates are intended for application in pressure vessels and for similar purposes excepting when exposed to fire or radiant heat.

The raw materials selected for melting and the steel making practices followed are such that the desired steel quality will be produced. Selective ingot or slab preparation together with special surface inspection of the finish rolled plate are requisites of this quality.

Certain chemical limits more restrictive than standard may be specified. One bottom longitudinal tension and one top transverse bend test are required representing each plate as-rolled. Special marking is required, consisting of the name or brand of manufacturer, manufacturer's test identification, the quality and minimum tensile strength specified.

Typical Specifications:

Ordinary boiler flange quality	ASTM A-285
Carbon silicon steel flange quality	ASTM A-201 and A-212

(3) *Structural quality* plates are intended for application in structures such as bridges, buildings, structural steel for locomotives, railroad cars, and other mobile equipment.

Not more than two longitudinal tension and two longitudinal bend tests taken at random are required from each heat.

No special marking is required other than the name or brand of the manufacturer, size, and heat identification.

Typical Specifications:

Steel for bridges and buildings	ASTM A-7
Structural-Steel for locomotives and cars	ASTM A-113

3 *Process* The steel shall be made by either or both of the following processes: open hearth or electric furnace.

4 *Heat Treatment* Carbon and alloy steel plates for flange or firebox quality over 2 in. in thickness shall be uniformly heat treated to produce grain refinement in accordance with the requirements as set forth in ASTM Specifications for Boiler Steel.

For alloy steel plates 2 in. and under in thickness the fabricator may elect to have the plates heat treated by the producer in line with the requirements of ASTM Specifications for Boiler Steel.

5 *Chemical Composition* The steel shall conform to the following requirements as to chemical composition. Other requirements may be specified by agreement between purchaser and producer within these limits.

Carbon,† max per cent	0.35
Manganese,† max per cent	
Min Tensile Strength, psi:	
Not over 55,000	0.80
Not over 70,000	0.90
Over 70,000	1.50
Silicon,† max per cent	1.30
Phosphorus, max per cent	
Structural (acid)	0.06
Structural (basic)	0.04
Flange	0.04
Firebox	0.035
Sulphur, max per cent	
Structural	0.05
Flange	0.05
Firebox	0.04

† For structural quality the limits of carbon, manganese, and silicon need not be specified. For flange quality the carbon limit is not applicable unless a minimum and maximum silicon content is specified.

6 *Ladle Analysis* An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of the applicable elements specified in Par. 4. This analysis shall be made from a test ingot taken during the pouring of the heat. The chemical composition thus determined shall be reported to the purchaser or his representative and shall conform to the applicable requirements specified in Par. 4.

7 *Tensile Properties* (a) The tensile strength shall be specified as a minimum limit in increments of 1,000 psi; the minimum tensile strength shall not be less than 44,000 psi and not greater than 80,000 psi.

For structural quality the minimum shall not exceed 60,000 psi; a maximum tensile strength may be specified with a range from minimum to maximum of 10,000 psi up to 60,000 psi exclusive, and for 60,000 psi minimum the range from minimum to maximum shall not exceed 12,000 psi. In the case of flange and firebox quality a maximum tensile strength may be specified, with a range of 10,000 psi up to 60,000 psi minima inclusive, but not more than 25 per cent of the specified minimum for steels of higher tensile strength.

(b) The minimum yield point shall be specified as not less than 50 per cent tensile strength and not over 65 per cent tensile strength, or at any intermediate value.

(c) The elongation should be appropriate for the tensility, quality, and thickness of the material in accordance with ASTM specification formulas and rules. Slight variation from the calculated elongation by formulas should not be considered as significant.

(d) Tensile strength only need be determined on the tension test specimen taken from the top of firebox plates, and it shall not exceed the specified maximum of the range by more than 2,000 to 5,000 psi depending on the applicable specification.

8 *Test Specimens* (a) For plates 2 in. and under in thickness the test specimens shall be prepared for testing from the material in its rolled condition unless otherwise specified.

(b) For plates over 2 in. in thickness the test specimens shall be prepared from the material in its heat-treated condition, or from full thickness samples similarly and simultaneously treated. (See Par. 3).

(c) Tension test specimens for firebox steel shall be taken from the top and bottom corners of the plate as rolled,§ parallel to its longitudinal axis, and for flange steel from the bottom corner of the plate only. For structural quality at least one tension test specimen shall be taken from each heat.

§ The term "plate as rolled" refers to the unit plate rolled from a slab or directly from an ingot in its relation to the location and number of specimens; not to its condition.

(d) For plates 2 in. and under in thickness, tension test specimens shall be the full thickness of the material with 8 in. gage length. For plates over 2 in. in thickness, tension test specimens shall be $\frac{1}{2}$ in. diameter by 2 in. gage length, and the axis of each such specimen shall be located midway between the center and the top or bottom surface of the plate.

(e) For plates up to 4 in., inclusive, in thickness, tension test specimens may be the full thickness of the material with 8 in. gage length, when adequate testing machine capacity is available.

(f) When so specified, test specimens representing the plates shall be stress-relieved by gradually and uniformly heating them to a temperature between 1100 and 1200 F (or a temperature range otherwise agreed upon between the manufacturer and the fabricator), holding at temperature for at least one hour per inch of thickness and cooling in still atmosphere to a temperature not exceeding 600 F.

9 *Permissible Variation in Thickness* No plate shall vary more than 0.01 in. under the thickness specified.

10 *Marking* shall be in accordance with the marking requirements of the ASTM or Government Specifications for applicable quality and grade.

Basic Regulations for Tubular Products

1 *Scope* (a) These regulations are a guide for the selection and acceptability of an appropriate specification for carbon[1] or ferritic alloy[2] steel tubular products to be used in the construction of pressure vessels and boiler pressure parts[3] under the general requirements of the ASME Code. Material cannot be purchased to these rules.

(b) Material conforming to ASTM, U. S. Government, or equivalent specifications of recognized specification-writing bodies (similar in respect to essential requirements) shall be acceptable for use, provided the requirements of (c), (d), and (e) are met.

(c) All definitions and testing procedure shall be in accordance with ASTM standards, latest issue.

(d) Other requirements which may be included in a specification are not considered to involve questions of safety beyond the responsibility of the manufacturer[4] and may be a matter of agreement between the producer[4] and the manufacturer.

[1] *Carbon Steel:* By common custom steel is considered to be carbon steel when no minimum content is specified or required for aluminum, boron, chromium, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium or zirconium, or any other element added to obtain a desired alloying effect; when the specified minimum for copper does not exceed 0.40 per cent; or when the maximum content specified for any of the following elements does not exceed the percentages noted: manganese 1.65, silicon 0.60, copper 0.60.

In all carbon steels small quantities of certain residual elements, unavoidably retained

(*Footnotes 1, 2, 3, and 4 continued at bottom of next column*)

2 *Process* (a) The steel shall be made by one or more of the following processes: open hearth, electric furnace, or acid Bessemer steel.

(b) The process for manufacturing pipe or tubes may be as follows: Seamless, furnace welding, electric resistance welding, fusion welding by electric arc or gas. Suitable tests for the soundness of the weld, and freedom from injurious defects shall be provided.

3 *Heat Treatment* (a) Pipe or tubes shall be annealed, normalized, tempered or stress-relieved during manufacture, as required by the selected specification. The finished product shall have suitable ductility and mechanical properties for the chemical composition as required by such specifications.

(b) All electric resistance welded boiler and heat exchanger tubes shall be normalized.

4 *Chemical Composition* The steel shall conform by ladle or check analysis to the chemical composition limitations of its type shown in the appended table. For carbon steel pipe, except when specified as killed, where the minimum specified tensile strength is 60,000 psi or lower, the only requirement for chemical composition shall be 0.06 per cent maximum phosphorus for open hearth steel and 0.11 per cent maximum phosphorus for Bessemer steel. A more restricted chemical composition within the limits shown may be specified by agreement between the manufacturer and producer.

5 *Tensile Properties* (a) Carbon and alloy steel pipe shall have a minimum tensile strength specified between 45,000 and 80,000 psi., except that carbon steel pipe for low temperature service (under —20 F) for seamless construction without welding may have a specified minimum tensile strength of not over 90,000 psi. The minimum tensile strength shall be specified in units of 1000 psi.

(b) The minimum yield point, or yield strength, when it is a requirement of the selected specification, shall not be less than 40 nor more than 65 per cent of the minimum tensile strength specified.

(c) The elongation should be consistent for the chemistry, tensility, thickness, and heat treatment required by the selected specification, but for material where the specified minimum tensile strength is 60,000 psi or over the longitudinal elongation in 2 in. shall not be less than 15 per cent.

(d) Seamless or welded tubes with carbon not over 0.20 per cent, carbon steel only, need not have the tensility specified.

6 *Fabricating Properties* The specification selected should provide for suitable mechanical tests to insure that the material will withstand fabricating operations contemplated, such as cold bending, coiling, flanging, expanding or flaring, and that for welded pipe or tubing the weld is sound, ductile and with full penetration.

7 *Permissible Variations in Weight and Dimensions*

(a) For tubes, the minimum thickness shall not be under that specified.

(b) For pipe, the minimum thickness at any point shall be not more than 12.5 per cent under the nominal wall thickness specified.

8 *Marking* Each length of tube or pipe shall be legibly marked to show the name or brand of the producer, whether seamless or welded and if welded the process used, the grade or type and the specification number. For small diameter material the required marking may be on a tag securely attached to the bundle or box in which the material is shipped.

from raw materials, are sometimes found which are not specified or required, such as copper, nickel, molybdenum, chromium, etc. These elements are considered as incidental and are not normally determined or reported.

[2] *Alloy Steel:* By common custom steel is considered to be alloy steel when the maximum of the range given for the content of alloying elements exceeds one or more of the following percentages: manganese 1.65, silicon 0.60, copper 0.60 or in which a definite range or a definite minimum quantity of any of the following elements is specified or required within the limits of the recognized field of constructional alloy steels: aluminum, boron, chromium up to 3.99 per cent, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, or any other alloying element added to obtain a desired alloying effect.

Small quantities of certain elements are present in alloy steels which are not specified nor required. These elements are considered incidental (chemical determinations are not required) and may be present to the following maximum percentages: copper 0.35, nickel 0.25, chromium 0.20, molybdenum 0.06.

[3] *Boiler Pressure Parts:* A part of a boiler subjected to hydrostatic pressure which has been fabricated by the boiler manufacturer, piping assembler, or boiler assembler from material supplied by a tube or pipe producer.

[4] *Manufacturer and Producer:* For the purpose of these rules, "manufacturer" refers to the fabricator of the pressure vessel or pressure part, and "producer" refers to the producer of the steel tube or pipe.

Chemical Compostition Limitations

(See Par. 4)

	Percentages		
	Carbon Steel	Alloy Steel[a]	
Carbon, max	0.35[c]	0.25	0.20
Manganese, max	1.00[c]	1.00	1.00
Phosphorus, max	0.04[d]	0.04	0.04
Sulphur, max	0.05[d]	0.05	0.05
Silicon, max	0.50[b]	0.50	2.00
Chromium, max			10.00
Molybdenum			0.40–1.25
Nickel		3.00–5.50	

[a] Carbon may be 0.25 per cent max for 0.65 per cent max molybdenum steel without chromium. Vanadium up to 0.25 per cent max may be present in the 1.25 per cent chromium steel in the absence of molybdenum. Titanium or columbium may be added in percentages up to 0.70 or 1.00 respectively to the chromium-molybdenum steels up to 6.00 per cent max chromium.

[b] For operating temperatures above 900 F, the silicon shall be 0.10 per cent min.

[c] For high tensile seamless pipe under UG-66, these limits may be exceeded.

[d] For pipe, accepted practice permits 0.05 per cent phosphorus and 0.06 per cent sulphur maximum.

THE ENGINEERING PROFESSION

News and Notes

As Compiled and Edited by A. F. Bochenek

Vast Engineering Manpower Project Launched by EJC

Objective: To Insure Supply and Optimum Utilization

PLANS for a vast campaign to inform the public of the importance of the engineering function and to insure more effective use of engineers in industry, construction, and the Armed Forces were approved by the Engineers Joint Council at a meeting held in the Engineering Societies Building, New York, N. Y., Jan. 19, 1951. James M. Todd, president EJC, was in the chair.

The program will be administered by the 20-man EJC Engineering Manpower Commission and will be supported by funds solicited from employers of engineers in business, industry, and in public and private construction.

The actions set a precedent for inviting financial support from non-EJC organizations for EJC projects from which they stand to benefit. In the same action EJC asked The American Society of Mechanical Engineers to assign its secretary, C. E. Davies, to the job of director of the EJC Engineering Manpower Commission.

The three main objectives of the EJC Engineering Manpower Commission, according to the formal plans approved by Council, will be: (1) To overcome future shortages of engineering graduates by increasing enrollments in engineering schools; (2) to assure better utilization of present engineering manpower by alerting employers of engineers about the need for better utilization caused by the impending shortage; and (3) to act as consultant to governmental bodies in order to assist in conservation of engineering manpower.

Plans for expanding the Commission call for (1) an executive committee composed of a chairman and a Commission member from each participating society; (2) an editorial committee composed of seven members each of whom is experienced in some phase of the manpower project; and (3) a development committee of six members whose function will be to raise necessary funds to carry on the program.

The Commission in Action

E. G. Bailey, temporary chairman of the EJC Commission, said that the Commission has placed itself at the disposal of the Scientific Manpower Advisory Committee of the National Security Resources Board headed by Charles A. Thomas, vice-president, Monsanto Chemical Company (see page 167, February issue of Mechanical Engineering). The Thomas Committee has called upon the EJC Commission for information in two instances. On Dec. 29, 1950, the Committee asked EJC to find out how many engineers and scientists were enrolled with the Armed Services Reserves. The following day the EJC sent a telegram to 95 companies asking for data. On January 4 the EJC was able to advise the Thomas Committee that, based on a ten per cent sampling of American engineers, 25 per cent of the engineers employed by 59 representative employers of engineers were enrolled in the active reserve.

The Commission, Mr. Bailey added, is currently collecting data for the Thomas Committee on availability of technicians, toolmakers, glassblowers, machinists, and other supporting personnel essential to the work of engineers.

EJC Water Policy Panel

Working Committees of the EJC National Water Policy Panel are being reactivated to study the 445-page report (see pages 167–168 of the February issue) recently made public by the President's Water Resources Policy Commission headed by Morris L. Cooke, Fellow ASME, consulting engineer, Philadelphia, Pa. This was announced in a progress report by W. W. Horner, chairman of the EJC Panel. Each Committee plans to compare by juxtaposition its own recommendations published in the 250-page EJC report on national water policy (see pages 673–674 of the August, 1950, issue) with those of the Cooke Commission.

Legislation incorporating recommendations of the President's Commission will be in shape for Congressional consideration in two months, Mr. Horner estimated. The EJC Panel is working to prepare a statement supplementing its first report which will provide legislators and other persons interested in water policy with point-by-point comment on recommendations of the Cooke Commission. Mr. Horner asked for an appropriation to cover cost of publishing the supplementary report. The appropriation was approved.

Unity

Continued progress by the Exploratory Group on Unity of the Engineering Profession was reported by H. S. Osborne, chairman of the EJC delegation to the Exploratory Group. Meeting on Dec. 16, 1950, the Group approved a document prepared by its working Committee in which four plans for engineering unity are proposed and discussed by various members of the 15-society Group.

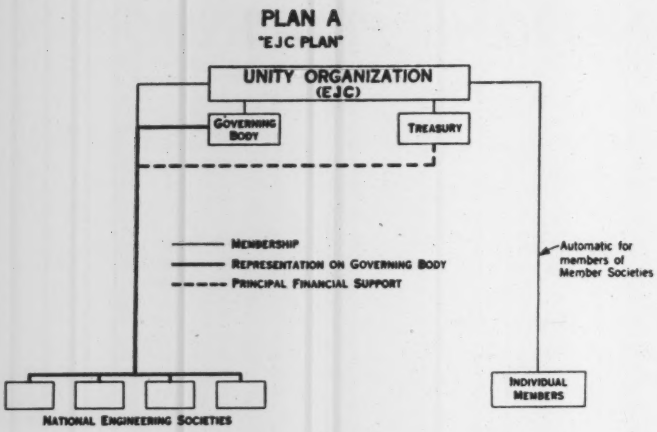
The report is to be circulated among the sections and chapters of EJC societies for eventual agreement on a single plan (for an account of the unity report see pages 254–255 of this issue).

UPADI Conference

Upon recommendation of its Commission on Latin America, EJC agreed to send delegates to the Havana Conference of UPADI (Union of Pan-American Societies of Engineers), April 19–22, 1951, the delegation to be made up of one representative from each constituent society.

EJC TAKES UP ENGINEERING MANPOWER PROBLEM AT JANUARY, 1951, MEETING IN NEW YORK, N. Y.

(*Left to right:* James M. Todd, president; C. E. Davies, director, and E. G. Bailey, temporary chairman EJC Engineering Manpower Commission).



ORGANIZATIONAL DIAGRAM OF PLAN A—EJC PLAN

(Unity organization would consist essentially of an expanded Engineers Joint Council. No direct individual membership provided for. Individuals pay dues through their national engineering society.)

Four Plans for Achieving Unity of Engineering Profession Proposed

Exploratory Group Urges Widest Possible Discussion

FOUR plans for achieving unity of the American engineering profession were approved for discussion by the Exploratory Group to Consider the Increased Unity of the Engineering Profession at its meeting in New York, N. Y., on Dec. 16, 1950.

The Exploratory Group, which consists of representatives of 15 professional engineering societies including The American Society of Mechanical Engineers, was established in June, 1949, when, upon invitation from the Engineers Joint Council, the engineering societies agreed to meet to explore means of increasing the unity of the engineering profession.

The four plans are the result of 18 months of informal negotiation during which the Exploratory Group met two times and its Planning Committee nine times.

The four plans, each of which envisages an over-all engineering society empowered to speak for engineers on professional aspects of the profession, have been suggested as follows: (1) Plan A, "EJC Plan"; (2) Plan B, "Modified EJC Plan"; (3) Plan C, "Merger Plan"; and (4) Plan D, "NSPE Plan."

Plan A, EJC Plan

This plan calls for expansion of EJC to include other engineering societies eligible to become members under the present EJC constitution which specifies that any national engineering society may join the EJC if qualifications required of its members classify them as constituting a recognized branch or group of the engineering profession. Individual engineers would be members of the unity organization by virtue of membership in a member national society. The governing body would consist of one to three representatives of each of the societies in the Exploratory Group. Financial support of the unity organization would come from member societies prorated according to membership. A per member charge from 50 cents to $1 is estimated. Engineers as individuals would have no representatives on the governing body nor would they be asked for dues payment.

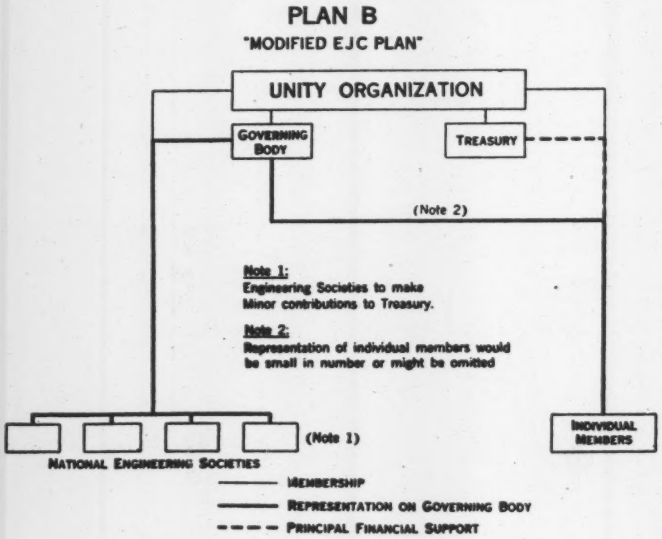
Plan B, Modified EJC Plan

This plan proposes expansion of the Engineers Joint Council to include other engineering societies and provides for voluntary individual membership. Societies represented on the Exploratory Group would join EJC. Later, other qualified national engineering societies would be invited to join. Individuals prominent in the engineering profession could become members of the unity organization whether or not they were also members of its constituent societies.

Plan B calls for a governing body of one to three representatives of each constituent society and a dues payment from member societies estimated from 10 to 25 cents per member. Individual members of the unity organization would be represented on the governing board by one to five representatives elected directly by individuals. Individual member dues would be about $10.

Plan C, Merger Plan

This plan contemplates the merger of EJC with the National Society of Professional Engineers and the expansion of the merged organization to represent the entire engineering profession. Membership in the Plan C



ORGANIZATIONAL DIAGRAM OF PLAN B—MODIFIED EJC PLAN

(Same as Plan A unity organization except individual memberships and individual dues payments provided for.)

unity organization would be open to any engineering society which meets a uniform requirement for a basic grade of membership. Membership by individuals qualified under ECPD basic membership grades is provided.

The governing body would include representatives of constituent societies in proportion to membership and financial support. Individuals would be represented through state societies, by a body equivalent to the present board of directors of the NSPE. The plan calls for a small board of directors to carry on active management of the governing board which would contain as many as 300 members.

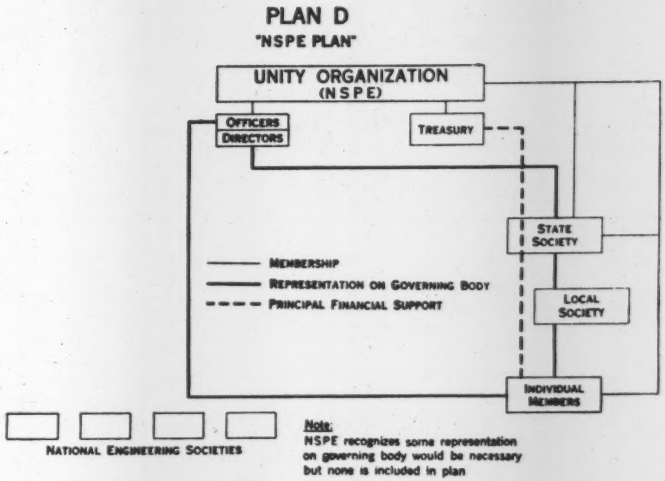
Financial support would come from assessments against member societies prorated according to membership. Individuals would pay dues fixed by the unity organization and collected by state societies.

Plan D, NSPE Plan

This plan proposes adoption of NSPE as the unity organization and expansion of NSPE membership and activities through co-operation of other engineering societies. Membership in the unity organization would consist solely of state professional societies incorporated in the NSPE. Only registered engineers would be eligible for membership in state societies. The governing body would be the board of directors of the NSPE. Financial support of the NSPE unity organization would come solely from individual dues collected by state societies. Professional engineering societies as such, not being members of the unity plan, would make no contribution to it.

Discussion on Local Level Sought

The four plans have been submitted to the governing bodies of societies participating in the Exploratory Group with a request that the plans be discussed fully and that an expression of opinion be submitted to the Group. Member societies were specifically requested to take no formal action in favor of any of the plans.



ORGANIZATIONAL DIAGRAM OF PLAN D—NSPE PLAN—UNITY ORGANIZATION

(This unity organization would follow the pattern set by the NSPE. National engineering societies would not be directly involved. Engineers who are registered would be eligible for membership in local and state societies affiliated with NSPE.)

Pres. J. Calvin Brown in a letter published on page 266 of this issue asks ASME Sections to express their views on this important matter.

The Group expects to meet during the summer to review actions of governing boards and, if possible, to recommend a single plan for the unity organization.

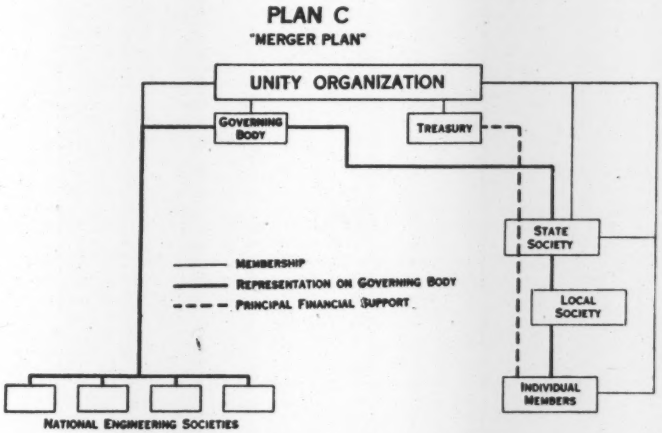
E. J. Kates Is ASME Representative

E. J. Kates, ASME representative on the Exploratory Group, in a statement to the planning committee, expressed his personal view about the importance of individual membership in any unity organization.

Such membership, he said, would (1) increase interest of individual engineers in the work of the unity organization; (2) the public and Government agencies would have greater respect for expressed opinions of the unity organization on questions of public policy with an engineering aspect; (3) directors of the unity organization elected directly by the individual members would make the organization more representative; (4) it would increase income of the organization and reduce financial burden on constituent national societies; (5) the unity organization would have greater financial stability if a major part of its income came from individuals; and (6) individual membership would be a badge of recognition by the profession as a whole and tend to increase the unity of the profession.

Societies participating in the Exploratory Group are: American Association of Engineers, American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers, The American Society for Engineering Education, American Society of Civil Engineers, American Society of Heating and Ventilating Engineers, American Society of Refrigerating Engineers, The American Society of Mechanical Engineers, American Water Works Association, Illuminating Engineering Society, Institute of Aeronautical Sciences, Institute of Radio Engineers, National Society of Professional Engineers, and The Society of Naval Architects and Marine Engineers.

The Society of Automotive Engineers resigned from the Group because its activities were considered outside the boundary of action specified by the SAE constitution.



ORGANIZATIONAL DIAGRAM OF PLAN C—MERGER PLAN

(Same as EJC Plan except individual memberships provided through NSPE state societies.)

1950, Year of EJC Achievement

THE year 1950 was a year of achievement for the Engineers Joint Council, according to L. E. Young, consulting mining engineer, Pittsburgh, Pa., president of EJC for 1950. In his annual report Dr. Young listed four projects in which the EJC took the initiative in serving the American engineering profession. These were (1) organization of the Engineering Manpower Commission, (2) sponsorship and completion of a Survey of Selected Engineering Personnel for the National Military Establishment, (3) a 250-page statement on national water policy, and (4) the naming of three members of the engineering profession by President Truman to the National Science Foundation Board.

Manpower

The Engineering Manpower Commission was organized as a result of a request from the National Security Resources Board for suggestions on "the most effective utilization of engineers in the national effort." The EJC Commission, whose new program is announced elsewhere in this issue, is not only interested in effective utilization of the national scientific and engineering manpower, but also in maintaining an adequate flow of students to engineering schools.

Survey

The EJC Committee on Survey of Selected Engineering Personnel secured data on 63,689 engineers of high standing, classified according to 253 specialties in which they were competent and ten major activities in the field of engineering in which they are engaged. These records were forwarded to government authorities and should be a valuable tool in the selection of key personnel by agencies of the government concerned with national security. A part of this task was that of writing definitions for each of the 253 fields of engineering specialization.

Water Policy

The EJC Water Policy Panel first began directing its attention to national water problems in 1947. Last year, with the appointment of the President's Water Resources Policy Commission, EJC created nine working committees which prepared a 250-page report incorporating the points of view of the engineering profession for submission to the President's Commission. With the release of the report of the Commission, EJC reactivated its working committees and is now engaged in the preparation of a supplementary report which will compare its own recommendations with those of the President's Commission, and make available point-by-point comment for legislators and other persons interested in national water problems.

National Science Foundation

EJC Science Legislation Panel has been watchful of engineering interests in governmental activities. When passage of the National Science Foundation Board bill was imminent EJC prepared a list of names of 24 eminent engineers qualified to serve on the National Science Foundation Board. As a result of EJC interest, three of the 24 men appointed to the Board by the President were those recommended by EJC.

Unusual Trends Attributed to Manpower Shortage

THE current critical shortage of graduate engineers is having a buoyant effect upon the employment of women engineers and on the starting salaries of recent graduates, according to Raymond D. Meade, placement director, Illinois Institute of Technology, Chicago, Ill. Mr. Meade is liaison officer between industry and graduating seniors at the Institute.

According to the *New York Times*, Mr. Meade noted the following "unusual trends" among American engineering employers:

1 Salary levels for beginning engineers have increased at least 10 per cent in the last four months.

2 No graduate is beginning at less than $275 a month and recently a company offered $500 a month for a qualified electronic engineer with a bachelor's degree. The average is $290 to $310.

3 Any engineering graduate can begin work the day after graduation.

4 Engineers in sales work and service operations in industry already are being channeled into strictly engineering functions.

5 On-the-spot hiring is taking place for the first time.

6 Research managers and heads of engineering departments are accompanying personnel men who normally interview, evaluate, and refer applications.

7 Companies are willing to accept men who are eligible for the draft if they have not received their first notice.

8 Training programs have been curtailed and eliminated except in the largest companies, and graduates are being placed immediately in engineering work.

* * *

Senior engineering students at Polytechnic Institute of Brooklyn, Brooklyn, N. Y., have an unlimited choice of job opportunities, according to John W. Andrews, director of employment services of the Institute. More than 3000 openings are listed on the job announcement board for the 500 men who will receive degrees in June. The shortage of engineers is such a real one, Mr. Andrews pointed out, that industry will interview now and hire 1951 June graduates regardless of possible draft status to insure a share of the new engineers. Only recently, he said, have job opportunities reflected the stepped-up defense program. The demand gives evidence of the presence now of the national shortage of engineering talent predicted for 1954.

Acceleration of Studies Becoming a National Problem

THE University of Pittsburgh and Drexel Institute of Technology are among the engineering colleges and universities who are accelerating engineering curriculums to help meet the shortage of technically trained personnel needed by industry and the Armed Forces.

Opposition to acceleration, however, was announced recently by seven leading Eastern schools. The schools are: Harvard University, Brown University, Columbia University, Massachusetts Institute of Technology, Princeton University, Tufts College, and Yale University.

A spokesman for this group said that the schools would not join the trend to the three-semester accelerated program. They would continue to start the freshman year in September. Experience has shown, the statement said, that from the point of view of both students and faculty, "a 45-week, three-term-a-year program is highly unsatisfactory and that intensive acceleration is justified only under war conditions." The United States was "not engaged in a global war nor committed to total mobilization."

According to the *New York Times*, E. C. Kastner, registrar of New York University and president of the American Association of Collegiate Registrars and Admissions Officers, holds that acceleration is needed to compensate the students for the loss of time in military service. Dr. Kastner predicted that acceleration would be considered by virtually every institution of higher learning. It was particularly important for qualified preprofessional students to complete their courses quickly.

On the other hand, Francis J. Brown, consultant for the American Council on Education, urged the colleges and universities not to create a "wave of acceleration" until one could be established on a uniform basis. Colleges were asked to delay the three-year program until they could comprehend the total picture.

"Many institutions have recently become concerned over the possibility that the Department of Defense might request academic acceleration in ROTC colleges and universities," reported the American Council on Education.

"Communications indicating the points of views of the services reveal that the Department of the Army thus far has had no occasion to request acceleration but has no objection if it is uniform. In the event of total mobilization, it will request acceleration."

A number of colleges have adopted a "stand-by" policy, waiting for developments before they embark on the three-year program.

Some institutions recognize they may be forced to establish a three-year program, but their hearts will not be in it. They point to their experiences in World War II, when the speed-up system proved distasteful to many faculty members and students alike.

A few institutions, such as the University of Denver, always have operated on the four-quarter plan, making acceleration possible for any student.

EJC Acts to Elucidate Selective Service Directive

THE Engineering Manpower Commission of the Engineers Joint Council acted recently to clarify for industry the meaning of a directive sent on Jan. 25, 1951, by General Lewis B. Hershey, director of Selective Service, to state directors and local selective service boards.

The telegram postponed for 30 days the induction of college students who are about to graduate and who have already received notices of induction.

The importance of the telegram to senior students and industry lies in the fact that it, in effect, cancels orders for induction and provides for reclassification of the registrant and restores all of his appeal rights. Prior to the issuance of the telegram, most college students classified 1-A had been given dates of induction following close upon their graduation. Such students were already classified and no appeal could be taken nor could their cases be reopened before the local board.

General Hershey's telegram allows a graduating engineer 30 days to find employment in industry. The telegram also authorizes local boards to reopen the cases of registrants who have secured employment and to reclassify them. Such action has the effect of canceling notices of induction even though the registrant is continued in 1-A. All of his appeal rights are restored and employers may take appeal immediately on notification of the new classification.

The EJC Commission sought elucidation on the intention of the telegram when it was learned that many employers have been confused as to its exact meaning and its relationship to prospective employees. Such misunderstanding, if it should occur among members of local selective service boards, might defeat the purpose of the telegram. The Commission warned industry that it may be necessary to request reopening of cases by state directors and to seek compliance with provisions of Mr. Hershey's telegram. It is suggested that requests for deferment by employers in behalf of recently employed or prospective employees be in the hands of local boards as soon as possible. This information constitutes new evidence on the basis of which proper reclassification can be made by the local boards.

EJC Expresses Views on Manpower Legislation

THE Engineering Manpower Commission of the Engineers Joint Council approved with reservations the Administration's Universal Military Service and Training bill at a public hearing of the Preparedness Subcommittee of the U. S. Senate Committee on Armed Services on Jan. 25, 1951.

The bill proposes induction of all 18-year-olds for 27 months' service and for the first three years the deferment of 75,000 annually after four months' basic training for study in engineering, medical, and social sciences. The deferred men would owe 23 months' service after graduation in critical industrial and military operations.

C. E. Davies, director of the EJC Commission, told the committee that the Administration bill was "an excellent approach to a critical problem." He urged, however, that the limitation of 75,000 deferees for the next three years be stricken from the bill and that the number of men deferred annually be allowed as a matter for presidential discretion.

In support of the suggestion, Mr. Davies said that American industry will need graduates that will result from 50,000 engineering-school freshmen annually for years and that with enrollment in the engineering colleges as at the present time, a cumulative shortage amounting to 40,000 graduate engineers is expected by 1954.

He pointed out that the Administration bill would defer only 75,000 for the fields of engineering, medicine, and other sciences, and the humanities, and hence this would fail to provide for 50,000 freshmen needed for engineering alone.

Mr. Davies' statement followed closely the views expressed by EJC on Dec. 20, 1950, in a letter to Robert L. Clark, director, Manpower Office, National Security Resources Board. (See pages 166–167 of February issue of MECHANICAL ENGINEERING.)

At the request of Philip N. Powers, secretary, Scientific Manpower Advisory Committee, EJC expressed its views in writing on plans proposed by Dr. Powers' committee to assure 75,000 freshmen for scientific and engineering training in the colleges and universities.

In its letter to Dr. Powers, the EJC Engineering Manpower Committee pointed out that to meet the requirements for engineers between 45,000 to 50,000 of the proposed freshmen should be permitted to study engineering.

Signed by E. C. Bailey, temporary chairman, EJC Engineering Manpower Commission, the letter also touched on two points not included in the Administration bill: (1) That engineers in the reserves now engaged in work essential to public health, safety, and interest, be given an opportunity to resign; and (2) that provision be included for deferment of supporting technical personnel to assure effective use of engineering manpower. Supporting skills such as those of draftsmen, instrument and toolmakers, and glass blowers are a necessary part of the team which engineers must lead.

Editors Find AEC Declassification Progress Satisfactory

DECLASSIFICATION of information useful to industry by the Atomic Energy Commission was judged as satisfactory by a working party of representatives of technical and engineering societies and the business press. This opinion was expressed in a report to AEC based on study of AEC classified patent files and an examination of an atomic plant.

The working party stated: "In no case have we uncovered any 'huge amount' of secret information of value to industry, although some specific cases of valuable information are noted in our reports."

In referring to the "specific cases of valuable information" in its reply to the working party's report, the Commission stated that "work is proceeding actively to consider this information for declassification and publication. No item of information will, of course, be declassified even though of value to American industry, in case our classification officers find that it might be of value to technological development by potential enemies."

Results of Survey

In its report, editors commented as follows on AEC information of interest to major divisions of engineering:

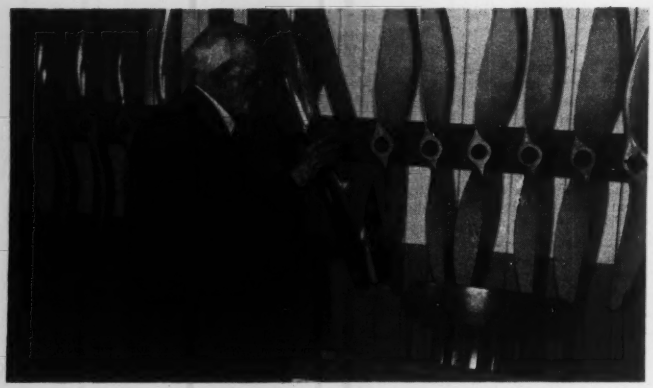
Mechanical: High-vacuum systems of novel construction, instrumentation, and equipment have been developed on the project, but have already become available to industry without further steps toward declassification. Techniques relating to valve construction, graphite machining, materials handling, and safety procedures are noteworthy, but of interest to an extremely limited field.

Electrical: Establishing and controlling the electrostatic and magnetic fields of the calutron does not differ, basically, from creating the same fields for other applications. However, certain electron circuits, apparatus details, and technical ingenuity are eminently publishable if declassifiable; staff should be encouraged to select those of greatest general interest and seek declassification for publication.

Chemical: The whole technique of electromagnetic separation is new and of great interest to industrial operations. Methods for separating rare metals could be carefully studied by industry; data on ion exchange of the rare earths, on use of oxygen to supplement an air feed to an incinerator unit, and on vacuum technology are examples of subjects of value to the chemical engineer in industry.

Certain control techniques, safety measures, and other novel developments could presumably be described in the literature without reference to the project. Further search can be expected to disclose a number of items of valuable information that should be submitted for declassification as improvements and extensions of techniques already used by industry.

Mtallurgical: Wartime necessity for prompt production enforced the use of materials already known to industry, and there appears to be no important information withheld concerning the plant apparatus and construction. However, many reports now classified contain summaries of corrosion and erosion data, and miscellaneous metallurgical data. To appraise and collate such information in a single declassifiable publication would seem to require the full-time effort of a competent chemi-



WILLIAM F. DURAND, PAST-PRESIDENT AND HON. MEM. ASME; PROFESSOR EMERITUS, STANFORD UNIVERSITY, STANFORD, CALIF., IS SENDING THE FIRST VARIABLE-PITCH PROPELLER HE DEVELOPED AND TESTED 33 YEARS AGO TO THE NATIONAL AIR MUSEUM OF THE SMITHSONIAN INSTITUTE, WASHINGTON, D. C., AT THE REQUEST OF PAUL E. GARBER, CURATOR

(The model revolutionized propeller design when tests run by Dr. Durand and the late Prof. Everett P. Lesley in a Stanford wind tunnel showed that the pitch of propeller blades, previously permanent, could be varied to give full power for specific flight demands. Propellers whose pitch is varied automatically in flight are now used on practically all but jet types of military and commercial airplanes. Dr. Durand's career distinguished by many firsts has been honored by his fellow engineers. He was the first winner of the Wright Brothers Memorial Trophy in 1948. He was the recipient of the John Fritz Medal Award in 1936; the ASME Medal, 1945; the Daniel Guggenheim Medal for Aeronautics; and many others. He was called out of retirement in 1941 to head the Government's development program on jet-propelled aircraft for which he received the medal of merit in 1948.)

cal engineer or metallurgist. Should a volume devoted to metallurgy be considered a practical avenue of publication, an important document could concern current work (rather than history) devoted to refining, alloying, fabricating, mechanical, and chemical properties of a group of relatively rare metals.

Members of Working Party

The members of the working party, who were appointed by the Commission's Ad Hoc Advisory Committee on Technological Information for Industry from among its own membership, are: E. E. Thum, chairman, editor, *Metal Progress*, and representative of the American Society for Metals; Keith Henney, consulting editor, *Nucleonics* and *Electronics*, and representative of the Institute of Radio Engineers; S. A. Tucker, publications manager, The American Society of Mechanical Engineers; and F. J. Van Antwerpen, editor, *Chemical Engineering Progress*, and representative of the American Institute of Chemical Engineers.

Information Officer Appointed

To follow up the recommendations of the working party the Commission recently appointed a technological information officer, N. H. Jacobson, formerly in charge of technical-press relations for the Allis-Chalmers Manufacturing Company, to the staff of the AEC. He will assist project authors in the preparation and distribution of declassified technical papers and will act as liaison with representatives of the professional and business press.

Science Adviser to State Department Named

JOSEPH B. KOEPFLI, of the California Institute of Technology, was recently named science adviser in the State Department with the responsibility of helping the department develop an international science program.

Creation of the office of science adviser was proposed last June in a report to the Secretary of State by Lloyd V. Berkner. The report, entitled "Science and Foreign Relations," proposed among other things the appointment of "top-flight American scientists" as scientific attachés in diplomatic posts abroad.

Dr. Koepfli's office will be instrumental in shaping United States foreign policies with respect to science. It will also serve as a central liaison office for the State Department's relations with the National Science Foundation, the National Academy of Sciences, the National Research Council, and other public and private science organizations.

National Science Foundation Board Holds First Meetings

THE National Science Board of the National Science Foundation met in Washington, D. C., on Dec. 12, 1950, and again on Jan. 3, 1951. James B. Conant, president, Harvard University, was elected chairman. Edwin B. Fred, president, University of Wisconsin, was named vice-chairman. Detlev W. Bronk, president, The Johns Hopkins University, was elected chairman of the Board's executive committee, which in addition to himself, Dr. Conant, and Dr. Fred is composed of the following: Chester I. Barnard, president, Rockefeller Foundation; Lee A. DuBridge, president, California Institute of Technology; Paul M. Gross, dean, Duke University Graduate School; Robert F. Loeb, professor of medical services, College of Physicians and Surgeons, Columbia University; Joseph C. Morris, vice-president, Tulane University; Elvin C. Stakman, chief, Division of Plant Pathology and Botany, University of Minnesota.

The Board's first task is to recommend to the President a candidate for the post of director of the Foundation.

Three of the 24 members on the National Science Foundation Board were recommended by the Engineers Joint Council. They are: Donald H. McLaughlin, president, Homestake Mining Company, San Francisco, Calif.; Edward L. Moreland, Mem. ASME, consulting engineer, firm of Jackson and Moreland, Boston, Mass.; and Andrey A. Potter, Fellow ASME, dean of engineering, Purdue University, Lafayette, Ind. Charles E. Wilson, Mem. ASME, president, General Electric Company, Schenectady, N. Y., is also a member of the Board.

Increasingly Important Role for Engineer Predicted

BY THE year 2000, scientists and engineers will not only be managing most of industry, but will be entering high places in government to formulate and administrate a sound, equitable, and efficient government.

This was the promising future for men and women trained in the sciences envisioned by Milton C. Whitaker, retired vice-president, American Cyanamid Company, who delivered the 1950 Chandler Lecture at Columbia University, New York, N. Y., Jan. 16, 1951. Prior to the lecture Mr. Whitaker was presented the 1950 Chandler Medal for outstanding achievement in the chemical industry.

Warning that industry has much to fear from laws which destroy self-reliance and independence of the individual, he said that "technical people will have to take on their responsibilities as citizens, inform themselves about what is going on, and exercise the sovereign power which they now own." He said he did not want to spoil technologists to make politicians, but an active part in public affairs was necessary if a democratic form of government was to survive.

Earlier in the lecture, Dr. Whitaker said that industry currently supports 2500 research and development laboratories employing some 150,000 persons of which 90,000 are scientists and technically trained personnel. These organizations had "nothing to do but produce ideas and facts and to demonstrate their usefulness.

Ideas, facts, and their proofs are all they have to sell, and industry is a willing buyer to the tune of about one billion dollars per year."

Productivity

NATIONAL productivity is keyed to the quality and size of management and engineering staffs serving industry, according to an editorial in the Dec. 29, 1950, issue of *Engineering*.

Commenting on the reports being submitted by some 35 British productivity teams who have been studying American industry, the editorial states, "They have made a sufficiently detailed comparison between the temporary state of American and British industry but they have not emphasized sufficiently the importance, from the long term point of view, of insuring that the British industry is adequately staffed with managers and technologists in something like the same proportions as are customary in America."

Supporting this point of view, the editorial quotes Sir Ewart Smith, who maintains that the "relation between the rates of increase of productivity in the United States and this country in the past 50 years has corresponded approximately but significantly to the relation between the rates of increase of those trained in applied science." Since 1900, when the productivity of the two countries was about equal, the United States index of productivity has increased approximately three per cent annually, whereas in Britain the rate of increase was about half this figure. Between the wars the number of men annually receiving bachelor's degrees in the United States was 3.6 per 100,000 of population as against a figure of 1.8 per cent in the United Kingdom.

Co-Operation With Schools Offered by Du Pont

A BELIEF that professors in engineering schools should spend a year in industry was expressed recently by Granville M. Read, chief engineer, E. I. du Pont de Nemours and Company. He made a concrete offer to provide places for some of them.

Mr. Read spoke before the Second Industry-College Conference on "Industry's Need for Engineers and Scientists," held at Case Institute of Technology, Cleveland, Ohio, Jan. 20, 1951.

Offering to take into the Du Pont Engineering Department several professors from engineering schools, he proposed "giving them twelve-month experience throughout our entire engineering organization. We will pay them their regular salaries plus reasonable expenses."

Mr. Read pointed out that new scientific discoveries and developments over the past century have opened up vast new fields for engineers. Today an engineer has many fields in which to practice his chosen specialty. But his training would be made a lot more valuable if those who teach him were aware of the viewpoints and problems of industry.

Referring to the trend to specialization, Mr. Read pointed out that his company's engineering department needs the support of 100 different branches of engineering with a well-rounded group of engineers in each with specialized knowledge in many fields.

There was an even more urgent need for broad-gage executive leaders with vision and a goodly quantity of the humanities, he continued. "It is my belief," he said, "that the key to quality leadership for our nation and its industries is in the hands of our colleges."

But to use this key successfully, colleges must clearly understand their problem, not as it used to be, but what it is today and will be tomorrow.

One of the best ways to acquiring this insight, Mr. Read concluded, is by working with industry and absorbing its know-how and an understanding of its problems.

Standardization by Government Opposed by Senator R. E. Flanders

A PLEA for keeping the control of industrial standards out of government hands was made by Ralph E. Flanders, senator from Vermont, in the January issue of the *Atlantic Monthly* magazine. Senator Flanders is an Honorary Member and past-president of The American Society of Mechanical Engineers.

"There are trends, plans, and proposals currently under way," Senator Flanders stated in his article, "that would make standardization wholly or mainly a function of government, and I am opposed to them. I do not want my talented, capable, and sincere friends in the federal agencies to write the industrial standards of this country. Too much is at stake.

"Standards are now built into the very structure of American industry," the Senator said. "They are the controls that management employs to direct smooth and efficient company operations. . . . If you control an industry's standards, you control that industry lock, stock, and ledger. On the day that standards become a governmental function and responsibility . . . the government will take a very long step toward the control of American industry. That is a step which will reach into every manufacturing and operating company, big and little, and consequently will affect every consumer in the country."

Senator Flanders states that in such a setup, government personnel would decide when and what standards should be developed and what the provisions of the standards should be. "That method," he declares, "is inflexible . . . . Standards made under such conditions tend to become limitations, controls, and restrictive procedures. They reduce consumer choice. The manufacturer obeys an order he had no part in formulating."

He cites the thousands of standards developed by the nation's technical societies and trade associations as proof that voluntary standardization on the consensus principle is the best and most practical system. He also describes the work in this field of the American Standards Association, which he calls "private industry's primary answer to the challenge of government control of standards activities."

He called for a modification of the voluntary consensus principle, however, in development of war standards, but insists that full use should be made of the technical and creative abilities of American industry and that war standards should not unnecessarily depart from current industrial practice.

ENGINEERING SOCIETIES HONOR NATIONAL BUREAU OF STANDARDS

(*Left to right:* T. G. Le Clair, president, AIEE; E. U. Condon, director, National Bureau of Standards; I. S. Coggeshall, president, IRE; and Ernst Weber, chairman, Joint AIEE-IRE Committee on High-Frequency Measurements.

At a luncheon ceremony during the Second Joint Conference on High-Frequency Measurements, in Washington, D. C., Jan. 11, 1951, the president of the American Institute of Electrical Engineers and of the Institute of Radio Engineers presented awards to the National Bureau of Standards in recognition of the Bureau's contributions to science and engineering in the past 50 years. The conference was jointly sponsored by AIEE, IRE, and NBS and was held, Jan. 10–12. The Bureau was established in 1901 and is the principal agency of the Federal Government for fundamental research in physics, mathematics, chemistry, and engineering.)

NMC Administers ECA Program of Technical Assistance

NMC Paris Office Opened

THE National Management Council during 1950 substantially expanded its activities in the international field, according to Eldridge Haynes, publisher, *Modern Industry*, and president NMC.

NMC has undertaken administration of a $280,000 program of technical assistance sponsored by the Technical Assistance Division of the European Cooperation Administration. To co-ordinate its operations overseas NMC opened an office in Paris, France. Among its new services to members is the *NMC International News Letter* and a series of research reports on management subjects of an international nature. These activities entailed a sixfold expansion of full-time staff.

NMC technical assistance services consist of organizing and conducting a special program designed to acquaint European management specialists with the American enterprise system and basic principles of production, marketing, and corporate organization as practiced in the U. S.

Beginning in June, 1950, NMC has conducted assistance programs for 21 French management men, 15 French consulting engineers, 15 Danish consulting engineers, a Norwegian team of engineers, and 50 accountants from Marshall Plan countries. Arrival of a team of West German managers is expected soon.

NMC Program for Visitors

For each group NMC prepares a tailor-made program which follows a general pattern. The visitors are first taken on a two-weeks' visit of American plants to acquaint them with American terminology and equipment. This is followed by a three months' study period at a university co-operating in the program. Here the visitors are introduced formally to basic principles of American management. The program concludes with a number of plant-inspection trips during which visitors spend as long as three weeks at each plant studying thoroughly those operations in management of special interest to them.

In planning programs and arranging itineraries, NMC has the co-operation of The American Society of Mechanical Engineers, the American Management Association, and other American management societies.

Two Limitations Set to NMC Operations

Commenting on the future activities, Mr. Haynes said that NMC recognized two limitations to its operations: (1) It plans to function only at the international level and will not compete with national management societies; (2) it will not engage in activities which can be done more effectively by private competitive enterprises organized for profit. The test for an NMC project is: Does it require voluntary co-operation from U. S. management?

Concluding his report, Mr. Haynes said American management does not "need the techniques of colonialism," nor does it "depend upon state investment" or armed aggression. The American way, he said, is more imaginative. It invests private funds, and uses good management to support the investment by raising living standards and developing local management talents.

The National Management Council was organized in 1933 as a top echelon co-operative and co-ordinating body to act as U. S. representative on the International Committee of Scientific Management (CIOS).

The following organizations interested in management are members of the NMC: American Management Association, Inc., The American Society of Mechanical Engineers, American Society for Public Administration, Association of Consulting Management Engineers, Inc., International City Managers Association, Life Office Management Association, National Office Management Association, Inc., and Society for the Advancement of Management, Inc.

Membership in the NMC is also open to commercial and industrial organizations.

Europe Needs American Business Philosophy NMC Hears

Lillian M. Gilbreth Honored at Annual Dinner

THE philosophy of business invented and developed by American business must be adopted by European industrialists if Europe is to survive as a free continent, according to William H. Joyce, assistant administrator, Economic Cooperation Administration, Washington, D. C. Mr. Joyce spoke at the Annual Dinner of the National Management Council, Hotel Pierre, New York, N. Y., Jan. 10, 1951.

The American doctrine of high wages, low prices, low unit profits, and mass production for a mass market has served the interests of workers, consumers, and business. The general philosophy of European business, he said, was based upon low wages, high prices, maximum unit profits, and restricted production for a limited market. The system works well for a few individuals, but top management in Europe must be persuaded to adopt new practices to obtain the benefits of low cost and high production.

Dr. Lillian M. Gilbreth Honored

Prior to Mr. Joyce's talk, Dr. Lillian M. Gilbreth, Fellow and Honorary Member, ASME, was awarded the 1950 Wallace Clark International Award for outstanding contributions in the field of scientific management. The award was presented to Dr. Gilbreth in recognition of over thirty years of service and contribution to the improvement and development of scientific management practices and application of its basic principles.

DR. LILLIAN M. GILBRETH, HONORARY MEMBER ASME, ABOUT TO RECEIVE THE 1950 WALLACE CLARK INTERNATIONAL AWARD FROM J. A. WILLARD, FELLOW ASME, AT ANNUAL DINNER OF THE NATIONAL MANAGEMENT COUNCIL, JAN. 10, 1951

Dr. Gilbreth became one of the nation's first consulting management engineers, and the first woman ever to practice the profession. She took up this work when her husband died in 1924, shortly before he was to present his paper to the congress of the International Committee for Scientific Management. In an unheard-of move, Mrs. Gilbreth decided to take his place, not only in presenting her husband's paper, but also in continuing his work. She has carried the pioneer work of time and motion study, conducted by her husband, into such fields as home economics and was one of the first to introduce scientific planning into agriculture. She also applied her talents to retraining of disabled veterans.

For the past 30 years Dr. Gilbreth has been a practicing consulting management engineer, teacher, and lecturer. She is past-director of the National Management Council and has held such positions as professor of management of Purdue University. She has been honored by many engineering and management societies.

U. S. Moves to Cut Red Tape In Procurement

TO speed up the buying and selling process involved in government procurement, the U. S. General Services Administration, which is in charge of the buying function for many government agencies, recently established regional offices in ten important and widely separated cities, according to Clifton E. Mack, Commissioner, Federal Supply Service, General Services Administration. These cities are: Boston, New York, Washington, Atlanta, Chicago, Kansas City, Dallas, Denver, San Francisco, and Seattle.

In each regional office GSA has made ar-

rangements to provide necessary information to direct suppliers and manufacturers to appropriate purchasing agents in the Government who buy their commodities. A short-form purchase order has been developed which enables a government agent to make purchases in the open market. This new form is limited to purchases of $500 or less except when used by GSA and the Department of Defense where it is limited to purchases of $1000.

Because of geographical considerations, purchases of some classes of federal supplies have been transferred from Washington to the New York and Chicago regional offices. Mr. Mack said that GSA intends to counteract the widespread belief among manufacturers and businessmen that, in general, doing business with the Government is a difficult matter.

Suppliers who want to be informed of Government needs should write to the regional GSA office for literature explaining facilities, production, and other business information.

ESL Revises Photoprint Service

THE Engineering Societies Library, New York, N. Y., recently announced a revised photoprint service. The ESL is now prepared to provide photoprints of any material available in the United States even though this may not be on file on ESL premises. The revised service is designed to conserve time and avoid inconvenience for subscribers. Requests for photoprints sent to the ESL will be met if material is available anywhere in the United States.

The following services are offered:

Material in Library: Photoprint copies can be supplied as negative (white on black) prints for 40 cents a print—minimum charge $1 per order. Any two facing pages which together measure not over 11 × 14 in. can be taken on one print. Larger material will require one print per page.

Material not in Library: Upon request, ESL will search for any engineering or technical article. If it can be located in this country, a photoprint copy will be supplied at our regular charge of 40 cents a print and an additional $3 service fee for locating the article. There will be no charge if the material cannot be located.

Requests for the service of searching for material not in Library may be placed on the basis of one or more articles, one order, or a blanket authorization may be given covering orders during any period of time, subject to cancellation by subscriber or the ESL on 30 days' notice.

Quotations will not be made on material not in Library. However, if reference indicates the inclusive paging of the article, a rough estimate can be made by assuming that each page will require one print. Because photoprints will be obtained from various sources, the print sizes may vary.

Copyrighted material will not be copied beyond recognized "fair use" without the signed authorization of the copyright owner. All responsibility for questions of copyright that may arise in the copying and in the use made of the copies must be assumed by the applicant.

Members of The American Society of Mechanical Engineers who order work for their personal, not company, use will receive: (1) Discount of 20 per cent on the service fee for locating the article; (2) a reduction of 5 cents on each photoprint.

Calculation Study Program Established

A PROGRAM of study to train specialists in scientific calculation, critically needed in key phases of American mobilization, was recently established at Columbia University, New York, N. Y. The Department of Pure Science of the International Business Machines Corporation is co-operating in the program and will make available its scientists and machine facilities. Some courses will be given by IBM staff members.

In explaining the need for the program, W. J. Eckert, director, IBM Department of Pure Science, pointed out that development of new weapons requires great mathematical and computational effort. Mathematicians handling these problems, he explained, must be familiar with the operation of the calculators and able to perform the vast amount of mathematical analysis necessary to prepare each problem for the machines.

Meetings of Other Societies

March 5–9
American Society for Testing Materials, spring meeting, Netherland-Plaza Hotel, Cincinnati, Ohio

March 11–17
International Industrial Exposition, Coliseum, Houston, Texas

March 13–16
National Association of Corrosion Engineers, 1951 conference and exhibition, Hotel Statler, New York, N. Y.

March 15–17
American Society of Tool Engineers, annual meeting, Hotel New Yorker, New York, N. Y.

March 16
Institute of the Aeronautical Sciences, 6th annual flight-propulsion meeting, Hotel Carter, Cleveland, Ohio

March 19–23
American Society for Metals, 7th Western metal congress and exposition, Civic Auditorium, Oakland, Calif.

March 26–30
American Management Association, production conference and seminar, Waldorf-Astoria Hotel, New York, N. Y.

April 3–5
Edison Electrical Institute, 17th annual meeting, Edgewater Beach Hotel, Chicago, Ill.

April 3–6
Greater New York Safety Council, 21st annual convention, Statler Hotel, New York, N. Y.

(For ASME Calendar of Coming Events see page 273)

High-Temperature Data Sought From Industry

AMERICAN industry was urged to make available to designers a "bonanza" of experimental data on the high-temperature properties of ferrous alloys now reposing in laboratory files, throughout the country. This plea was made by C. L. Clark, metallurgical engineer, special steel developments, The Timken Roller Bearing Company, Canton, Ohio, before a public hearing held in the Engineering Societies Building, New York, N. Y., Jan. 23, 1951, and arranged by C. E. Chapman, chairman of the Subcommittee on Stress Allowances for Ferrous Materials of the Boiler Code Committee of The American Society of Mechanical Engineers.

Data Needed for Code Revision

The Subcommittee is revising the table of allowable working stresses in Section VIII of the ASME Boiler Construction Code to bring this table in line with latest fabrication and service experience with the commonly used ferrous metals.

The Committee's proposal was based on the "Strength of Wrought Steels at Elevated Temperature" by R. F. Miller and J. J. Heger, a report published by the ASTM-ASME Joint Committee on Effect of Temperature on the Properties of Metals.

According to Dr. Clark, revision of the table of stresses was handicapped by lack of data, which, he said, was a reflection on industry for not having acquired more information about the steels it uses so extensively. High-temperature data available for setting more accurate allowable design stress does exist, but is not channeled to the code-making agencies either because some organizations do not wish to release such data or do not want to search their files and arrange data in usable form when invited to do so.

Industry Representatives Participate

The hearing was attended by some fifty representatives of the marine, public-utility, chemical, and process industries in which metals are used at elevated temperatures. C. E. Chapman, chairman of the Ferrous Stress Subcommittee, as first speaker explained the basis for revising the stress tables. R. F. Miller and Dr. Clark discussed the source material used by the committee. M. B. Higgins explained the Committee's procedure for establishing stress qualifications. W. B. Hoyt discussed the proposed design stresses from the standpoint of safety alone as they related to design of unfired pressure vessels. P. M. Brister presented the point of view of designers of boilers, furnaces, and superheater components and H. A. Wagner covered the point of view of main steam-piping designers.

The point of view of consumers who wish to use design stresses more conservatively than the minimum determined necessary for safety was presented by Walter Saman and Herman Weisberg.

The hearing was concluded with questions from the floor.

Applied Mechanics Reviews Adds New Features

BEGINNING with the January, 1951, issue, a revamped *Applied Mechanics Reviews* emerged as an enlarged review journal featuring a lead survey article by J. P. Den Hartog on "Dynamics and Vibration," and incorporating other innovations. The lead articles will appear monthly and will be written by outstanding applied-mechanics men who will survey their particular fields. Articles also have been prepared by Hugh L. Dryden of the National Advisory Committee for Aeronautics on "Turbulence" and by J. H. Greidanus of the National Aeronautical Research Institute, Amsterdam, Holland, on "Aeroelasticity," for the February and March issues, respectively.

Changes in the *Reviews* format include a new two-color cover and a new title page. Subject headings and running heads have also been redesigned.

Now in its fourth year of operation, *Applied Mechanics Reviews*, which presents critical reviews of the world literature in applied mechanics, has been hailed as a "must" tool for research personnel in universities, government and industrial laboratories, and industry, in general, throughout the world. Among the wide variety of subjects covered by the *Reviews* are the following: Aerodynamics, aeroelasticity, compressible flow, flow and flight-test techniques, propellers, fans, turbines, pumps, hydraulics, elasticity, experimental stress analysis, buckling problems, structures, properties of materials, mechanics, ballistics, lubrication, and many more.

Under the editorship of Martin Goland, Mem. ASME, of the Midwest Research Institute, *Applied Mechanics Reviews* is published by The American Society of Mechanical Engineers and the following co-operating organizations: Office of Air Research, Midwest Research Institute, American Society of Civil Engineers, Institute of Aeronautical Sciences, American Institute of Physics, American Mathematical Society, Society for Experimental Stress Analysis, The Engineering Institute of Canada, and The Institution of Mechanical Engineers (Great Britain).

AEC Training Available to Men in Industry

INDUSTRIAL organizations interested in obtaining special training in nuclear-reactor technology for experienced engineers in their employ are invited to sponsor their enrollment in the 1951–1952 session of the Oak Ridge School of Reactor Technology, Oak Ridge, Tenn. Application deadline is April 1, and the school term begins Sept. 10, 1951.

Established in 1949 at the Oak Ridge National Laboratory, the school operates a 12-month session open to two categories of engineering candidates. A limited number of recent college graduates are accepted in category *A* in the status of student employees. Category *B* students are selected from the applications sponsored by government agencies and private industrial firms interested in participating in the AEC national nuclear-energy program. Such firms need not be connected with the AEC currently.

Officials of the Oak Ridge Reactor School point out that the majority of problems encountered in the field of nuclear engineering involve the same fundamental engineering and management skills common to industry generally. This school offers an unparalleled opportunity for experienced engineers to obtain a thorough understanding of the specialized problems the AEC deals with in its nuclear-engineering program. Trainees remain on the pay rolls of their home organizations, and upon returning after completion of the course, can be expected to help strengthen their companies' position to participate in the national atomic-energy program.

Further information and application forms may be obtained by writing to the Director, Oak Ridge School of Reactor Technology, P. O. Box P, Oak Ridge, Tennessee.

Since much of the material presented in the curriculum of the Oak Ridge School of Reactor Technology will be classified, all enrollments are contingent upon a personal security investigation. Announcements of appointments will be in April.

Diesel Design and Maintenance Subject of Recent DEMA Symposium

THE LONG period now required to train engineering graduates for Diesel-engineering design would be considerably reduced if engineering colleges and universities could give more attention to certain of the practical problems facing the industry today. This point was made by C. F. Pervier, manager, Diesel-engine engineering, Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa., in a recent educational symposium sponsored by the Diesel Engine Manufacturers Association. From one to five representatives of more than a dozen engineering colleges in the east were guests of the corporation for the symposium and tour of its plant at Eddystone, Pa.

Although students usually come out of engineering schools well equipped in their basic understanding of engineering fundamentals, Mr. Pervier said, they also should be prepared for the shock of facing the serious problems that the Diesel industry is struggling to solve. Such problems are not presented in the textbooks.

As an example of the type of problem which might be handled without adding more equipment than is presently in use in most colleges, he suggested that students actually make necessary design changes in an existing proved engine to increase its output above its normal rating. Thinking along these lines would give student engineers a better insight into the problems that they will encounter when they begin working in their chosen field. Another problem is the demand for maximum interchangeability of parts with existing equipment.

The maintenance problem for Diesel locomotives was discussed by R. P. Johnson, general manager, Service Department of Baldwin-Lima-Hamilton Corporation. The difference in requirements in maintaining steam and Diesel locomotives was pointed out as the chief source of difficulties, along with inadequacies of maintenance shops and personnel. These conditions, however, he said, are fast disappearing.

Four ways of instructing railroad men in proper maintenance of Diesel locomotives were outlined. Service engineers are placed at points of delivery until the men can operate and maintain them properly. Second, service engineers are permanently located at strategic points in order to keep railroad men up to date. Third, maintenance manuals are designed to be complete in all details of adjustment, operation, and maintenance. Fourth, training of railroad personnel is taken to them rather than given in a plant school. Panels with mounted circuits, projectors for slides and charts, and other demonstration equipment is used in the field, often in the railroads' own instruction cars.

Three-Day Program to Be Offered At Midwest Power Conference

Sherman Hotel, Chicago, Ill., April 4–6

THE thirteenth annual meeting of the Midwest Power Conference will be held April 4–6, 1951, at the Sherman Hotel, Chicago, Ill. The program will consist of 26 technical and general-interest sessions, three luncheons, and a dinner. The technical sessions will be devoted to subjects covering all phases of the power industry.

The conference is sponsored by the Illinois Institute of Technology in co-operation with nine Midwestern colleges and universities and nine local and national engineering societies. Its purpose is to offer an opportunity for all persons interested in power production, transmission, or consumption to meet together annually for the study of mutual problems.

The Chicago Section of The American Society of Mechanical Engineers is sponsoring two sessions and the opening luncheon at which John T. Rettaliata, vice-president, ASME Region VI, will speak on jet propulsion.

For further information concerning the conference, write to Edwin R. Whitehead, Conference Secretary, Illinois Institute of Technology, Technology Center, Chicago 16, Ill.

Wednesday, April 4

Spreader Stokers for Larger Boilers, by *J. S. Bennett, 3rd,* Mem. ASME, vice-president, American Engineering Company, Philadelphia, Pa.

The Trend Toward Reheat, by *H. G. Ebdon,*

Mem. ASME, vice-president, Combustion Engineering-Superheater, Inc., New York, N. Y.

The Ground-Water Resources of the Midwest, by *Frank C. Foley*, district geologist, U. S. Department of the Interior, Madison, Wis.

High-Voltage Transmission, by *S. B. Crary*, Mem. ASME, analytical division, Application and Service Engineering Divisions, General Electric Company, Schenectady, N. Y.

Extra-High-Voltage Transmission, by *H. P. St. Clair*, system planning engineer, American Gas & Electric Service Corporation, New York, N. Y.

Mechanical Design and Construction, by *H. C. Schroeder*, Mem. ASME, partner, Sargent & Lundy, Chicago, Ill.

Electrical Design and Construction, by *John C. Woods*, station design engineer, Commonwealth Edison Co., Chicago, Ill.

Operating Experiences, by *Ralph B. Gutekunst*, Mem. ASME, chief engineer, Ridgeland Station, Commonwealth Edison Company, Chicago, Ill.

Motor Speed Control on AC Power Systems, by *E. W. Seeger*, vice-president in charge of development, Cutler-Hammer, Inc., Milwaukee, Wis.

Grounding of Industrial Systems, by *W. C. Bloomquist*, General Electric Company, Schenectady, N. Y.

Thursday, April 5

The Development of Organics for Water Treatment, by *J. A. Holmes*, Mem. ASME, assistant vice-president, National Aluminate Corporation, Chicago, Ill.

Organic Agents in Boiler-Scale and Sludge Control, by *John J. Maguire*, director, technical division, W. H. and L. D. Betz, Philadelphia, Pa.

Organic Synergists in Foam Control, by *C. M. Bodach*, chief chemist, and *L. O. Gunderson*, Mem. ASME, assistant vice-president, Dearborn Chemical Company, Chicago, Ill.

The Use and Misuse of Organic Water-Conditioning Materials, by *Robert W. Liddell*, Mem. ASME, and *Louis C. Bishop*, Hall Laboratories, Inc., Pittsburgh, Pa.

Microwaves for Relaying, Control, and Communication, by *A. W. Adams*, relay section, System Engineering Branch, Bonneville Power Administration, Portland, Ore.

Factors in the Choice of Microwave or Carrier Current for Power-System Operation and Dispatching, by *F. C. Krings*, Central Station Engineering Division, General Electric Company, Schenectady, N. Y.

A Method of Estimating the Ultimate Analysis of Bituminous Coals From the Proximate Analysis, by *Edward W. Jerger*, Mem. ASME, assistant professor of mechanical engineering, and *John R. May*, instructor of chemical engineering, Iowa State College, Ames, Iowa.

Operating Experiences With Combination Blast-Furnace Gas, Coke Breeze, and Oil-Fired Boiler at Wisconsin Steel, by *C. D. Northam*, Mem. ASME, superintendent, and *John T. Harvey*, Mem. ASME, assistant superintendent of steam power, Wisconsin Steel Works, International Harvester Company, Chicago, Ill.

Practical and Workable Air-Pollution Control Ordinances, by *Joseph C. McCabe*, Mem. ASME, associate editor, *Power*, New York, N. Y.

A High-Speed Load-Frequency Control System, by *T. L. Mell*, Brown Instrument Division, Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.

Excitation Control, by *M. Temoshok*, power generation division, Central Station Engineering Divisions, General Electric Company, Schenectady, N. Y.

Electronic Excitation, by *J. E. Barkle* and *D. F. Schanhle*, central station engineers, Westinghouse Electric Corporation, East Pittsburgh, Pa.

Retractable Soot Blowers in Central Station Boilers—Comparison of Air and Steam Blowing, by *D. E. Hibbner*, vice-president, Vulcan Soot Blower Division, Continental Foundry and Machine Company, Dubois, Pa.

Minimizing Fireside Deposits by Humidification of Combustion Air, by *Paul Murphy, Jr.*, Jun. ASME, boiler-room engineer, and *John D. Piper*, chemical supervisor, research laboratory, The Detroit Edison Company, Detroit, Mich.

The Tennessee Valley Authority Hydroelectric Program, by *Harry Wiersema*, assistant to the chief engineer, Tennessee Valley Authority, Knoxville, Tenn.

Problems in Power-Plant Design for Reclamation Multiple-Purpose Projects, by *Ireal A. Winter*, head, hydraulic machinery division, Bureau of Reclamation, Denver, Colo.

Influence of Freezing on Heat-Pump Ground-Coil Capacity, by *A. D. Kafadar*, Mem. ASME, and *I. B. Fieldhouse*, research engineers, Armour Research Foundation, and *R. A. Budenholser*, Mem. ASME, professor of mechanical engineering, Illinois Institute of Technology, Chicago, Ill.

Balancing Large Turbogenerator Rotors, by *P. R. Heller*, Mem. ASME, and *C. H. Janthey*, design engineers, AC generator section, Westinghouse Electric Corporation, East Pittsburgh, Pa.

Pumped Storage Hydro-Electric Power, by *William J. Rheingans*, Mem. ASME, assistant manager, hydraulic department; *Frank E. Jaski*, Mem. ASME, assistant chief engineer, hydraulic department; and *H. H. Roth*, application engineer, motor and generator section, Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

New Materials and Construction Methods for Small Power Plants, by *C. Maxwell Stanley*, Mem. ASME, partner, Stanley Engineering Corporation, Muscatine, Iowa.

Load Characteristics and Economics of Electric House Heating, by *W. F. Friend*, Jun. ASME, Ebasco Services, Inc., New York, N. Y.

Friday, April 6

Trends in Power-System Grounding, by *E. T. B. Gross*, professor of electrical engineering, Illinois Institute of Technology, Chicago, Ill.

The Delta-Grounded Transformer Development and Application, by *H. L. Hoeppner*, Pioneer Service and Engineering Company, Chicago, Ill.

Experience With Silica-Removal Demineralizer Plants, by *S. B. Applebaum*, Mem. ASME, manager, Cold Process Division, Cochrane Corporation, Philadelphia, Pa.

Boiler Feedwater Treatment for a High-Pressure High-Make Up Power and Steam Producing Plant, by *V. J. Calise*, Mem. ASME, technical director, Graver Water Conditioning Company, New York; *J. H. Harlow*, Mem. ASME, chief mechanical engineer, and *H. Farmer*, chief chemist, Philadelphia Electric Company, Philadelphia, Pa.; and *H. Lane*, chief chemist, Graver Water Conditioning Company, New York, N. Y.

Use of Diesel Generating Units on the Northern States Power Company System, by *E. F. Carlson*, results engineer, and *H. H. Rhoades*, general superintendent of electrical plant section, Northern States Power Company, Minneapolis, Minn.

Power Generation by Gas Turbines, by *A. G. Mellor*, power generation division, General Electric Company, Schenectady, N. Y.

Atomic Energy—A Review of Fundamentals, by *Frank H. Spedding*, director, Institute of Atomic Research and Ames Laboratory, Iowa State College, Ames, Iowa.

Atomic Energy and the Power Industry, by *George G. Brown*, director, engineering division, Atomic Energy Commission, Washington, D. C.

Progress Report on the Coal-Burning Gas Turbine, by *J. I. Yellott*, Mem. ASME, director, and *P. R. Broadly*, Mem. ASME, assistant director of research, Locomotive Development Committee, Baltimore, Md., and *F. D. Buckley*, Mem. ASME, manager, research and development division, Locomotive Development Committee Project, American Locomotive Company, Dunkirk, N. Y.

Notes on Coming Meetings

Heat Transfer

THE Heat Transfer and Fluid Mechanics Institute to be held at Stanford University, Stanford, Calif., June 20–22, 1951, was organized in the spring of 1948 for the purpose of establishing an annual meeting of breadth and quality which would make a definite contribution to the scientific advancement and intellectual growth of the Western community.

The meetings of the Institute have been held in California to reduce the effect of geographical isolation of engineers and scientists in the West Coast area and to provide an opportunity for these men to keep in touch with the latest advances in the fields of heat transfer and fluid mechanics. It is, however, the intention of the Institute to maintain participation on a nationwide basis.

Sponsors of the Institute are: Stanford University, University of California, University of Santa Clara, California Institute of Technology, University of Southern California, and the Hydraulics, Heat Transfer, Applied Mechanics, and Gas Turbine Power Divisions of The American Society of Mechanical Engineers.

The meeting will consist of a series of six technical sessions at which 18 papers will be presented, covering the general fields of heat transfer and fluid mechanics and related subjects. This year it is planned to have the complete papers available at the meeting in preprint form. A limited number of additional copies of the preprints will be available for purchase by mail immediately following the meeting.

Accommodations will be available in the Stanford University dormitories. For further information contact A. L. London, Department of Mechanical Engineering, Stanford University, Stanford, Calif.

Combustion

A CONFERENCE on "Combustion of Industrial Fuels" will be held at the University of Michigan, Ann Arbor, Mich., March 21–22, 1951, under the sponsorship of the University's school of engineering.

The conference will take up the combustion of solid, liquid, and gaseous fuels in industrial applications. Engineers from utilities, industry, research, and educational organizations have been invited to attend. Operating and design problems of interest to engineers with medium and small industrial power and heating plants will also be discussed. Other papers will take up: Industrial gas furnaces; heating of industrial furnaces by radiation from gas-fired tubes; cyclone furnaces; better engineering for small steam plants; evaluation and purchasing of coal; burner testing of fuel oils; and theory and practice of steam-air jets for improved combustion.

For conference details, write to the Institutes Department, Extension Service, University of Michigan, Ann Arbor, Mich.

German Fair

THE 1951 West German Industry Fair will be held at Hanover, Germany, April 29–May 8, 1951. On display will be new industrial products, precision equipment, and machinery as well as consumer goods of some 3200 exhibits.

Materials Handling

THE National Materials Handling Exposition sponsored by the American Materials Handling Society will be held at the International Amphitheatre, Chicago, Ill., April

30–May 4, 1951, concurrently with the Materials Handling Conference.

Among the topics of prime interest will be bulk-handling and storage methods for solids, yard-handling methods for pipe, structural steel and odd shapes, ways to beat wet grounds and bad weather in yard handling, incoming raw materials and components, co-ordinated handling through the production cycles, plant warehousing and shipping, and hard-goods assorting and warehousing."

Three sessions will be devoted to unit-loading and packaging methods, a series of recent developments which is engaging major attention among engineers and production executives. One session will consider such unit loading with pallets and skids; a second, without pallets; and a third, to the latest developments in unit load packing and packaging.

Other sessions will include a discussion of fundamentals; methods of making a materials-handling survey; relationship of handling to other departments; analysis of what constitutes materials-handling costs, and methods of presenting a materials-handling program to top management.

The six acres of exhibits and the outdoor area of four acres will comprise the most extensive display ever assembled of cost-reducing handling equipment in operation.

Diesel Engines

A PANEL discussion on Diesel engines will be one of the features of the 1951 National Convention of the American Society of Lubrication Engineers to be held at the Bellevue-Stratford Hotel, Philadelphia, Pa., April 16–18, 1951. The panel, composed of representatives of manufacturers and users of Diesel power, will take up lubricating problems in the marine, railroad, stationary, and high-speed Diesel fields and in the bus and truck industries. W. P. Green, Mem. ASME, professor, Illinois Institute of Technology, will head the panel.

The Annual Lubrication Show, also sponsored by the ASLE, is being planned to meet the demands being made on industry for higher speeds in wartime production and will feature lubricants, lubrication devices and appliances, and the latest developments in filtration equipment.

Literature

Oil and Gas Engine Power

A REPORT on Oil and Gas Engine Power Costs for 1949 was recently published by The American Society of Mechanical Engineers. The report is prepared annually by the Subcommittee on Oil-Engine Power Cost of the ASME Oil and Gas Power Division.

The scope of the 1949 report was extended to include operating cost data on dual-fuel and gas engines. Data are included on 17 plants with a total of 38 dual-fuel engines and four gas-engine plants with a total of ten gas engines.

The function of the report, according to the Subcommittee, is limited to fact-finding. The report does not establish conclusions and makes no interpretation of the facts published. No facts are included on cost of operating railroad Diesel engines because this task is being undertaken by the American Railway Engineering Association.

This report includes information on performance and production costs. Production cost, as relating to plants, is defined as consisting of the following items: Fuel cost; lubrication cost; cost of attendance and superintendence; cost of supplies and miscellaneous; cost of engine and all other plant repairs. Data obtained from 122 oil and gas-engine generating plants, containing 448 engines, totaling 432,703.5 rated bhp are given. Copies of the 40-page report may be obtained from the ASME Order Department, 29 West 39th St., New York, N. Y. Price per copy is $2.50.

Management

A BIBLIOGRAPHY on "Management of Construction Jobs" was recently published by the Engineering Societies Library, 29 West 39th Street, New York 18, N. Y. The bibliography was prepared to make easily and quickly available the small amount of published information directly pertinent to construction job organization and management scattered throughout the mass of management literature, most of which deals with the manufacturing industries.

The publication contains 52 annotated references to books and periodicals dealing with construction-job planning, work scheduling, costing, organization, preparation of material-requirement charts, material-delivery time scheduling, job progress records, time studies, material and equipment control, and contracting procedures. Price per copy is $2.

Coatings for Gray Iron

A MANUAL on "Metallic and Nonmetallic Coatings for Gray Iron" was recently published by the Gray Iron Founder's Society, Inc., 210 National City – E. 6th Building, Cleveland, Ohio. The 76-page manual describes practical methods of applying all known types of coatings to gray iron. It was written to facilitate product economies and conserve vital alloys now in short supply and under rigid government controls. Price per copy is $1.75.

Plasticity

A BIBLIOGRAPHY on Plasticity containing more than 1800 references was recently published by The American Society of Mechanical Engineers. Compiled by Dimitri Kececioglu, Jun. ASME, on the staff of Purdue University, Lafayette, Ind., the bibliography is intended to serve as the key to sources of practically all available knowledge on the theory of plasticity, particularly of metals, and its application to engineering problems. In his foreword, Mr. Kececioglu says that in spite of the great importance of the theory of plasticity, its introduction into machine design, product design, and its use in explaining plastic flow phenomena and plastic forming processes, has been delayed. Although the idea of plasticity was conceived about the year 1835, our present knowledge on the theory of plasticity and its application is based on theoretical research conducted in the United States, Germany, England, and Russia during the past 15 years. The 191-page bibliography contains a chronological index, subject index, and an author index. Price per copy is $2.25

AUBRY V. HUTCHINSON, EXECUTIVE SECRETARY (AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS) WAS HONORED RECENTLY BY ASHVE MEMBERS FOR 25 YEARS OF LOYAL SERVICE TO THE SOCIETY

(The bronze plaque was presented to him by Lauren E. Seeley, Mem. ASME, and president ASHVE. Dr. Seeley is dean of the College of Technology, University of New Hampshire.)

ECPD

THE 1950 list of accredited undergraduate engineering curriculums and accredited technical-institute programs in the United States was recently published by the Engineers' Council for Professional Development. The list contains 659 curriculums being offered at 142 engineering schools. More than 50 approved technical-institute programs being offered in 19 different schools are also listed. Price is 25 cents.

* * *

PERSONS concerned with the training and professional development of young engineers will be interested in the Eighteenth Annual Report of the Engineers' Council for Professional Development, recently published by the ECPD. The report contains a review of the ECPD program and the actions of its various committees. The list of accredited undergraduate engineering curriculums and accredited technical-institute programs is also a part of the report. Copies may be obtained from ECPD, 29 West 39th Street, New York 18, N. Y. Price is 50 cents per copy.

People

Paul Wooton Honored at SBME Dinner

AT a Business Mobilization Dinner held at the Hotel Statler, Washington, D. C., under the auspices of the Society of Business Magazine Editors, Jan. 19, 1951, Paul Wooton, Washington representative of Chilton Publications, received the first award of the Silver Quill, established by the National Business Publications "for most distinguished services to the business press through his development of better understanding and more productive co-operation between the various agencies of the federal government and the trade, technical, scientific, and professional publications of America."

The award was announced before an audience of 550 guests of SBME by Rufus Choate, vice-president, National Business Publications, and the presentation was made by the President of the United States. John W. McPherrin, editor, *American Druggist*, and president SBME, acted as toastmaster. Mr. Wooton is chairman of the executive committee, SBME, and was its first president.

After the presentation ceremonies, Gen. William Henry Harrison, administrator, National Production Authority, spoke on the scope and purpose of NPA and the task ahead of it and the nation. A resolution, passed by the Society at a meeting which preceded the dinner, in which the editors pledged "to arouse and support the kind of productive effort that will demonstrate the omnipotent power of the free spirit," was read and received amid applause.

Approximately 100 trade, technical, scientific, and professional magazines are members of SMBE. Meetings are held about every other month, generally in Washington, at which Cabinet officers, members of the Congress, and representatives of government agencies present off-the-record comments on the national scene.

At a luncheon meeting which preceded the dinner the society was addressed by John D. Small, chairman, Munitions Board, Michael Di Salle, Price Administrator, and John Gall, Washington attorney and leading authority on labor problems.

R. E. Brunswick Sharp Elected Fellow ASME

R. E. BRUNSWICK SHARP, chief engineer, S. Morgan Smith Company, York, Pa., has had a major part in the development of the modern hydraulic turbine. He has been in responsible charge of the design of probably a greater total horsepower of installations than any other living engineer, and he has notably contributed to the advancement of the art.

He was born in New Orleans, La., March 7, 1886, and was graduated from Tulane University in 1906 with a BE (mechanical and electrical) degree. Actually, Mr. Sharp spent 38

PRESIDENT HARRY S. TRUMAN PRESENTS SILVER QUILL AWARD TO PAUL WOOTON, WASHINGTON REPRESENTATIVE OF CHILTON PUBLICATIONS. (THE AWARD WAS ESTABLISHED BY THE NATIONAL BUSINESS PUBLICATIONS)

years with the I. P. Morris Company, Philadelphia, Pa., staying on when the company was purchased by William Cramp and Sons Ship and Engine Building Company in 1911 and 1930 when the Baldwin Locomotive Works purchased the I. P. Morris Division. In 1944 he went with the S. Morgan Smith Company as consulting engineer and in 1949 was made chief engineer of the company.

Some of the early projects with which Mr. Sharp is identified are: Holtwood Project, Pennsylvania Water and Power Company; Keokuk Project, Mississippi River Power Company; and plants of The Cedar Rapids Manufacturing and Power Company and Niagara Falls Power Company. During his tenure as chief engineer of the I. P. Morris Division, Baldwin Locomotive Works, the company designed and built the following principal installations of hydraulic turbines: Wheeler Development, TVA; Chickamauga Development, TVA; Reclamation Department, Hoover Dam; and the Ixtapantongo Development for the Mexican Government. Since 1948, as chief engineer of the S. Morgan Smith Company, he has worked on such projects as the turbines for the McNary Dam, The Nantahala Power and Light Company, and, now under construction, a 30,500-hp impulse turbine for the Tata Power Company for installation near Bombay, India.

He is the author of several technical papers, the section on hydraulic turbines in "Kent's Mechanical Engineers' Handbook," 10th and 11th editions, and the section on impulse turbines, "Mechanical Engineers' Handbook," 5th edition, edited by L. S. Marks. He holds more than 15 U. S. Patents pertaining to hydraulic engineering.

To be qualified as a nominee to the grade of Fellow one must be an engineer who has acknowledged engineering attainment, 25 years of active practice in the profession of engineering or teaching of engineering in a school of accepted standing, and has been a member of the Society for 13 years. Promotion to the grade of Fellow is made only on nomination by five Fellows or members of the Society to the Council to be approved by Council.

* * *

H. H. BLACHE, consulting mechanical engineer, Burmeister and Wain, Copenhagen, Denmark, has been named the recipient of the 1951 James Watt International Medal by The Institution of Mechanical Engineers in recognition of his outstanding achievements in the art and science of mechanical engineering, and particularly for his pioneer work in the development of the large marine-Diesel engine.

* * *

ISAAC HARTER, Fellow ASME, chairman of the board, The Babcock & Wilcox Tube Company, Beaver Falls, Pa., was awarded the Newcomen Medal "for achievement in the field of steam," at a joint meeting of the Newcomen Society and The Franklin Institute in honor of Benjamin Franklin's birthday, Jan. 17, 1951.

* * *

LAUREN E. SEELEY, Mem. ASME, dean of the college of technology and director of the Engineering Experiment Station, University of New Hampshire, Durham, N. H., has been elected 1951 president of the American Society of Heating and Ventilating Engineers. Other officers elected were: First vice-president, ERNST SZEKELY, Mem. ASME; second vice-president, R. F. TAYLOR; and treasurer, H. E. SPROULL.

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EVERETT S. LEE, Fellow ASME and past-president AIEE, was recently appointed editor of the *General Electric Review*, monthly engineering magazine published by the General Electric Company.

Dr. M. T. Huber, Applied Mechanics Authority, Is Dead

DR. MAKSYMILIAN TYTUS HUBER, professor of applied mechanics, Technical University, Gdansk-Wrzeszcz, Poland, international authority in applied mechanics, died in December, 1950, according to a letter recently received from Poland. Dr. Huber was well known as a participant in most of the World Congresses of Applied Mechanics, both as an author and a member of organizing committees.

Dr. Huber was a past-president of the Polish Academy of Technical Sciences and a member of many other Polish and international organizations in the field of applied mechanics. He was the author of the theory of the maximum energy of distortion, a work published in 1904. In 1921 he published "The Theory of the Orthotropic Plates." He contributed some 200 papers to the literature of applied mechanics in Polish, German, and French. His latest work was "Theory of Elasticity," in two volumes, which was reviewed in the November, 1949, and October, 1950, issues, respectively, of *Applied Mechanics Reviews*. Dr. Huber was a member of the panel of reviewers for that publication.

The President's Letter

Unity in the Engineering Profession

To ASME Members:

FOR a considerable period many members of your Society have expressed interest in a better organization of the engineering profession.

The problem has been under intensive study for over a year by a group representing 15 engineering societies. Their first report is now available and has been sent to the officers of the Sections of the Society for consideration and comment. Members who are interested in this problem are urged to secure a copy of the report from the officers of their Section and make their views known to them.

Opinions are desired about four plans which are outlined in the report. These plans, roughly, are:

1 Increasing the number of participating societies in the present Engineers Joint Council.

2 Increasing the number of societies in Engineers Joint Council and, in addition, providing for membership by individuals.

3 Combining Engineers Joint Council with the National Society of Professional Engineers.

4 Delegating to NSPE those matters affecting the relationship between the engineer and the public.

As in all matters of this sort, sound organization depends upon thorough understanding and careful consideration. The Exploratory Group, the name designating the representatives of 15 societies, emphasizes the fact that final action on any plan is not contemplated at this time. The report is submitted for comment and opinion to guide the further work of the Exploratory Group which hopes that as a result of these comments a plan or plans may be submitted to the individual societies for formal consideration.

The engineering profession has had a number of organizations dealing with matters of common concern to the engineering profession and at the present time two agencies are carrying on important work in this field. One of these is the Engineers Joint Council which consists of representatives of five societies and is concerned primarily with relationships between the engineering profession and the public. The other agency is the Engineers' Council for Professional Development with seven participating societies in the United States and one in Canada. This body is concerned with the training and development of the young engineer from his high-school days to the time he is fully accepted as a member of the engineering profession.

Thus we have a pattern of co-operation on which some new plan might be built.

The presentation of the report of the Exploratory Group gives each member an opportunity to express his views on an important matter affecting the future of the Society and the profession.

J. Calvin Brown, *President*, ASME

(For a description of the four proposed plans see pages 254–255 of this issue)

ASME NEWS

Manpower Developments to Be Reviewed at 1951 ASME Spring Meeting

Headquarters: Atlanta Biltmore Hotel, Atlanta Ga., April 2–5

ENGINEERING manpower developments which may affect every member of the engineering profession will be the topic at the President's Luncheon at the 1951 Spring Meeting of The American Society of Mechanical Engineers to be held at the Atlanta Biltmore Hotel, Atlanta, Ga., April 2–5, 1951.

The Spring meeting will be an unusual event because it combines three programs on various levels of Society activity. Because of careful planning by officers of ASME Region IV and the Atlanta Section, members attending the 1951 Spring Meeting will be able to participate in the Region IV Administrative Committee Meeting to be held on Sunday, April 1, the Region IV Student Branch Conference on Monday, April 2, and a full-scale national meeting of the Society.

Technical Program

The technical program will consist of 20 sessions at which 42 papers will be sponsored by the following committees and professional divisions: Fuels, Power, Production Engineering, Junior Committee, Machine Design, Education Committee, Textile, Management, Materials Handling, Wood Industries, and the Safety Committee.

Of special interest will be a symposium on cooling towers sponsored by the Power Division. Seven papers on this subject will cover economic factors in design, selection, operation and maintenance; recirculation in cooling towers; operating experiences, various problems relating to operation and maintenance; and deterioration of wood in cooling towers. Other symposiums will take up dual-fuel firing, and utilization of waste fuels.

An interesting application of engineering will be discussed by John Spear, secretary, Rich's Inc., Atlanta, Ga., during a management session, at which he will talk on department-store engineering. The Management Division is sponsoring four technical sessions and a luncheon.

Junior Conference

The National Junior Committee in co-operation with the Machine Design Division and the Education Committee, is sponsoring a conference at which one junior member designated by each of the Sections in Region IV will discuss the topic "A Current Plan for Young Engineers." B. P. Graves, Fellow and Director at Large ASME, and director of design, Brown & Sharpe Manufacturing Company, Providence, R. I., will tell some of the opportunities that lie in the field of machine design. E. W. O'Brien, past-president ASME, will also address the conference.

Region IV RAC Meeting

Members of ASME Region IV should consider early registration so that they can sit in on the Regional Administrative Committee Meeting beginning at 9 a.m., Sunday, April 1. Two delegates from each Section in Region IV will attend this meeting to take up an agenda touching on many phases of Society administration. A Dutch-treat luncheon is planned for 12:15 p.m., following which the Committee will reconvene and continue its work until 5:30 p.m. At this time there will be a reception for the delegates. The meeting will reconvene again at 8 p.m. and complete its work.

Student Conference

The Region IV Student Branch Conference to be held on Monday, April 2, has been so arranged that members can attend student competitions and so that students can attend the President's Luncheon to hear Pres. J. Calvin Brown speak on engineering manpower developments, and later to hear the Roy V. Wright Lecture. The program of the conference appears on page 268 of this issue.

William H. Ruffin, Banquet Speaker

The social high light of the Spring Meeting will be the banquet on Wednesday, at which William H. Ruffin, president, National Association of Manufacturers, will be the main speaker. Other social events will be the Textile Luncheon on Tuesday and the Management Luncheon on Wednesday, at which Frank F. Groseclose, director, School of Industrial Engineering, Georgia Institute of Technology, will speak on "The Importance of Southern Industry to the National Economy."

The student banquet on Monday will provide a fitting climax to the Region IV Student Branch Conference. Toastmaster will be S. D. Moxley, vice-president ASME Region IV. The banquet will wind up the Region IV Student Conference and will be the occasion for presenting awards to winners in the student-paper competition.

Tuesday evening of the program has been set aside for fun and good fellowship. Members will be guests of the Atlanta Section at a traditional Southern barbecue.

Roy V. Wright Lecture

The second Roy V. Wright Lecture will be delivered by Frank H. Neely, chairman of the board, Rich's Inc., on Monday, April 2.

The Lecture was established in 1949 to honor Roy V. Wright, president of the Society in 1931, as a tribute to his contributions as a citizen to the nation and his community. The purpose of the lecture is to impress on engineers and young people the duties and privileges of citizenship in a democracy.

Mr. Neely is eminently qualified to deliver the lecture because of his unique career in department-store management. As a disciple of Taylor and Gantt, Mr. Neely applied the principles of scientific management to the operations of Rich's department store with the result that this organization was built into one of the finest establishments in the South and became one of the institutions of Atlanta known throughout the world. (An account

THE GENERAL MOTORS CORPORATION ASSEMBLY PLANT FOR BUICK, OLDSMOBILE, AND PONTIAC CARS, ONE OF THE MANUFACTURING FACILITIES TO BE VISITED DURING THE 1951 ASME SPRING MEETING, APRIL 2–5

Student Branch Conference

Monday, April 2

8:00 a.m.

Registration

9:00 a.m.

Student Branch Conference convenes.

12:15 p.m.

President's Luncheon

Presiding: Paul H. Nichols, chairman, ASME Atlanta Section

Address of Welcome: The Honorable Herman E. Talmadge, Governor of Georgia

The Honorable William B. Hartsfield, Mayor of Atlanta

Speaker: Pres. J. Calvin Brown, Fellow ASME

Subject: Engineering Manpower Developments

2:30 p.m.

Student Branch Conference reconvenes.

5:00 p.m.

Roy V. Wright Lecture

Introduction: Blake R. Van Leer, president, Georgia Institute of Technology, Atlanta, Ga.

Lecturer: Frank H. Neely, chairman of the board, Rich's Inc., and chairman, board of directors, Sixth District Federal Reserve Bank, Atlanta, Ga.

6:30 p.m.

Student Banquet

Toastmaster: S. D. Moxley, vice-president, ASME Region IV, American Cast Iron Pipe Company, Birmingham, Ala.

Awarding of prizes

9:00 p.m.

Student Dance

Students! Attend the Spring Meeting!

of Mr. Neely's career was published in the February, 1950, issue of MECHANICAL ENGINEERING, page 183.)

Plant Trips

On Monday afternoon members will have an opportunity to visit the General Motors Corporation Assembly Plant in Five Point, Ga. This visit should be especially interesting to wives since the plant is an assembly unit of final production of Buick, Oldsmobile, and Pontiac automobiles. At normal production the plant employs 1500 persons. It consists of two main structures, a manufacturing building, and an administration building, situated on the 386-acre site. The roof area of the manufacturing building alone is $17\frac{1}{2}$ acres. Hundreds of parts and metal stampings for assembly flow daily into the plant from other General Motor plants throughout the country. To get the car parts to the right place at the exact moment required for assembly as the car moves along the line, an intricate split-second time schedule is necessary and is one of the fascinating features of the plant.

On Tuesday afternoon members have an invitation to visit the Harrison Hightower Textile Engineering Building of the Georgia Institute of Technology, which is situated only a short distance from the headquarters hotel. This building, one of the finest of its kind, was dedicated in October, 1950. The Institute has trained men for the textile industry since 1899. The superb facilities of the new building, which contains weaving, yarn manufacturing, and dye departments, was made possible by the farsighted policy of the Institute officials and Southern textile industry. Visitors will be shown the various laboratories which are equipped on a full-scale commercial basis. Of special interest will be the yarn testing laboratories.

Visits have also been arranged to the Atlantic Steel Company, Atlanta, Ga., which since 1901 has been supplying the needs of Southern industry for steel products. The company's three open-hearth furnaces produce 175 thousand tons of steel annually. Visitors will have an opportunity to see the open-hearth furnaces, soaking pits, blooming and billet mills, and rod and wire mills. Of special interest will be the nail manufacturing operation and wire-fence fabrication.

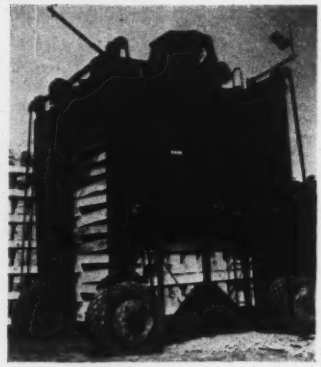
Interesting operations in the manufacture and preservation of railroad cross ties, bridge timbers, floor blocks, and other wood products will be open for inspection by members of the Society on Tuesday afternoon when a visit is planned to the Southern Wood Preservation Company situated in the suburbs of Atlanta. Plant operations embrace receiving, storing, manufacturing, treating, and shipping numerous wood items required by railroads, power companies, telephone companies, and construction corporations. Of particular interest will be the mechanized equipment which handles ties from the cars in which they are received through mechanical stacking equipment and then to the storage bins by means of especially constructed trams and straddle carriers.

Women's Program

An interesting program has been arranged for the wives and guests of members. The program will commence on Monday with the President's Luncheon. In the afternoon there will be a tea at the G.I.T. president's home, Georgia Institute of Technology, with Mrs. Blake R. Van Leer as hostess. The ladies are invited to the Roy V. Wright Lecture at 5 p.m., and to the student dance to be held at Georgia Institute of Technology.

On Tuesday visits are planned to the two chief monuments to the Confederate cause in the War Between the States: The cyclorama painting of the battle of Atlanta and the Stone Mountain Confederate Monument.

On Wednesday there will be a luncheon with style show sponsored by Rich's Inc. at the Piedmont Driving Club. The program will conclude with the banquet on Wednesday.



A LOAD OF RAILROAD CROSS TIES BEING TRANSPORTED AT THE PLANT OF THE SOUTHERN WOOD PRESERVATION COMPANY, ONE OF THE PLANTS TO BE VISITED DURING THE ASME SPRING MEETING, ATLANTA, GA., APRIL 2–5, 1951

MONDAY, APRIL 2

8:00 a.m.

Registration

9:30 a.m.

Fuels (I)

Dual-Fuel Firing

Multifuel Burners, Their Application and Design, by *William H. Decker*, Assistant Chief Combustion Engineer, Sinclair Refining Company, East Chicago, Ind.

The Use of Oil and Gas in Stoker Equipped Furnaces, by *John A. Hayes*, Assistant General Manager, Combustion Equipment Division, Todd Shipyards Corporation, New York, N. Y

9:30 a.m.

Power (I)

Symposium on Cooling Tower

Economic Factors in the Design of Cooling Towers, by *A. R. Le Basily*, partner, Sargent & Lundy, Chicago, Ill. (51—S-5)

Comments on Cooling-Tower Economics, by *Louis Elliott*, consulting mechanical engineer, Ebasco Services, Inc., New York, N. Y. (51—S-6)

Selection, Operation, and Maintenance of Industrial Cooling Equipment (Cooling Towers and Air-Cooled Exchangers), by *Howard E. Degler*, technical director, The Marley Company, Inc., Kansas City, Kansas (51—S-7)

Recirculation in Cooling Towers, by *Joseph Lichtenstein*, consulting engineer, Foster Wheeler Corporation, New York, N. Y. (51—S-8)

9:30 a.m.

Production Engineering (I)

What is Foundry Sand? by *Douglas C. Williams*, associate professor, department of industrial engineering, Ohio State University, Columbus, Ohio.

Sand Reclamation at the Eddystone Plant, by *Karl S. Howard*, vice-president, and *Clyde B. Jenni*, metallurgist, General Steel Castings Corporation, Eddystone, Pa.

12:15 p.m.

President's Luncheon

Presiding: *Paul H. Nichols*, chairman, ASME Atlanta Section.

Address of Welcome: The Honorable *Herman E. Talmadge*, Governor of Georgia, and The Honorable *William B. Hartsfield*, Mayor of Atlanta.

Speaker: *The President, J. Calvin Brown*, Fellow ASME.

Subject: **Engineering Manpower Developments**

2:30 p.m.

Inspection Trip

Buick, Oldsmobile, and Pontiac Assembly Plant, General Motors Corporation, Chamblee, Ga. (Buses furnished courtesy of ASME Atlanta Section)

2:30 p.m.

Power (II)

Symposium on Cooling Towers (continued)

Operating Experiences with Cooling Towers in the Central Gulf Area, by *H. G. Hiebeler*, assistant superintendent power, Houston Lighting and Power Company, Houston, Texas (51—S-9)

Problems Relating to the Operation, Maintenance, and Chemical Control of Forced and Induced-Draft Cooling Towers for Steam-Electric Generating Stations, by *V. F. Estcourt*, general superintendent of steam generation, Pacific Gas and Electric Company, San Francisco, Calif. (51—S-10)

The Deterioration of Wood in Cooling Towers, by *R. H. Baechler*, chemist, Forest Products Laboratory, and *C. A. Richards*, plant pathologist in charge, Madison Branch, Bureau of Plant Industry, Soils, and Agricultural Engineering, Madison, Wis. (51—S-11)

Fuels (II)—Power (III)

Utilization of Waste Fuels

Power From Wood Waste, by *E. A. Carsey*, assistant chief engineer, Kirk & Blum Manufacturing Company, Cincinnati, Ohio; *W. H. Kuhn*, sales engineer, Fairfield Engineering, Marion, Ohio; and *Denard Gusler*, plant engineer, Bassett Furniture Industries, Inc., Bassett, Va.

Developments in Spreader Firing of Wet Wood, by *A. S. Weigel*, manager stoker engineering, Combustion-Engineering Superheater, Inc., New York, N. Y., and *J. A. Freiday*, mechanical engineer, Ebasco Services, New York, N. Y.

2:30 p.m.

Production Engineering (II)

Production of Cast-Iron Pipe Centrifugally in Sand-Lined Molds, by *Kenneth R. Daniel*, chief engineer, American Cast Iron Pipe Company, Birmingham, Ala.

Relationship Between Modern Foundry Methods and the Quality of Castings, by *Frank R. Elliott*, superintendent of refrigeration and foundry operations, Westinghouse Electric Corporation, Springfield, Mass.

5:00 p.m.

Roy V. Wright Lecture

Introduction: *Blake R. Van Leer*, president, Georgia Institute of Technology, Atlanta, Ga.

Lecturer: *Frank H. Neely*, chairman of the board, Rich's Inc., and chairman, board of directors, Sixth District Federal Reserve Bank, Atlanta, Ga.

6:30 p.m.

Student Banquet

Toastmaster: *S. D. Moxley*, Vice-President, ASME Region IV, American Cast Iron Pipe Company, Birmingham, Ala.
Awarding of prizes

9:00 p.m.

Student Dance

TUESDAY, APRIL 3

9:00 a.m.

Junior—Machine Design (I)—Education

Machine Design as a Career in Industry, by *B. P. Graves*, consultant in design, Brown & Sharpe Manufacturing Company, Providence, R. I. (51—S-3)

Junior Conference on the Subject: **A Current Plan for Young Engineers.**

Speaker: *E. W. O'Brien*, vice-president, W. R. C. Smith Publishing Company, Atlanta, Ga.

Junior Representatives from each of the ten sections in Region IV will participate as leaders of the discussion. They will attend as guests of the Old Guard.

9:30 a.m.

Textile (I)

ASME Analyzes Textile Mill Modernization, by *Leslie A. Runion*, manager, engineering department, M. T. Stevens & Sons Company, Division of J. P. Stevens & Company, Inc., North Andover, Mass.

An Analysis of Fiber Blending, by *William F. Leineweber, Jr.*, chief engineer, Textile Equipment Corporation, Greenville, S. C.

9:30 a.m.

Power (IV)

Current Operating Results and Developments in Mercury-Steam Power Plants, 1949–1950, by *Harold N. Hackett*, engineer, Knolls Atomic Power Laboratory, Schenectady, N. Y. (51—S-12)

Mercury Boiler Treatment With Titanium and Magnesium Metal, by *Richard C. Reid*, construction engineering, General Electric Company, Schenectady, N. Y. (51—S-13)

Natural Steam Power Plants in Italy, by *Giuseppe Donata*, resident representative, E. Marelli & Company, c/o FED, at Westinghouse Electric Corporation, East Pittsburgh, Pa. (51—S-14)

9:30 a.m.

Wood Industries

The Mechanism of Wood Preservation and Wood-Preserving Plants, by *J. Alvin Vaughan*, research engineer, Southern Wood Preserving Company, Atlanta, Ga.

The Nail, an Indispensable Fastener, by *E. George Stern*, research professor of Wood Construction, Virginia Polytechnic Institute, Blacksburg, Va. (51—S-18)

12:15 p.m.

Textile Luncheon

2:30 p.m.

Inspection Trips

Inspection of Hightower Textile Engineering Building, A. French Textile School, Georgia Institute of Technology (Within walking distance of Atlanta Biltmore Hotel)

Southern Wood Preserving Company, East Point, Georgia (Buses furnished courtesy of ASME Atlanta Section)

Atlantic Steel Company, Atlanta, Georgia (Buses furnished courtesy of ASME Atlanta Section)

2:30 p.m.

Materials Handling (I)—Management (I)

Materials Handling in Distribution, by *S. Stokes Tomlin, Jr.*, distribution engineer, marketing, Shell Oil Company, New York, N. Y.

A New Approach to Determine Materials-Handling Equipment Requirements, by *James R. Bright*, editor, Modern Materials Handling, Boston, Mass.

5:30 p.m.

Social Hour and Barbecue

WEDNESDAY, APRIL 4

9:30 a.m.

Management (II)

Department-Store Engineering, by *John F. Spear*, staff assistant to general superintendent, Rich's Inc., Atlanta, Ga.

The Integration of Organization and Management, by *Robert Teriot Livingston*, executive officer, and *David Bendel Herts*, assistant professor, department of industrial engineering, Columbia University, New York, N. Y. (51—S-1)

9:30 a.m.

Textile (II)

Cotton-Fiber Properties—A Factor in Selecting Textile Raw Materials, by *Earl E. Berkley*, director, Anderson Clayton & Company, Houston, Texas.

Textile Plant Layout, by engineer from Roberts & Company, Atlanta, Ga.

Power (V)—Fuels (III)

Effect of Taper on Screw-Thread Load Distribution, by *E. E. Stoeckly*, advanced design division engineer, Aircraft Gas Turbine Divisions, General Electric Company, Lynn, Mass., and *H. J. Macke*, graduate student, department of engineering, Harvard University, Cambridge, Mass. (51—S-15)

The Steam-Generating Station as a Source and Sink for the Heat Pump, by *James A. Eibling*, research engineer, and *Bertrand A. Landry*, supervisor, Battelle Memorial Institute, Columbus, Ohio (51—S-16)

Fuel Availability and Its Influence on Boilers and Burning Equipment, by *P. R. Loughin*, chief staff engineer, The Babcock & Wilcox Company, New York, N. Y. (51—S-17)

9:30 a.m.

Machine Design (II)

Determination of the Effective Strained Length of Standard Stud Bolts, by *Robert S. Sherwood*, associate professor of mechanical engineering, Iowa State College, Ames, Iowa, and *Richard C. Dove*, assistant professor of mechanical engineering, University of New Mexico, Albuquerque, N. Mex. (51—S-2)

Shot Peening as a Factor in the Design of Gears, by *John C. Straub*, chief research engineer, American Wheelabrator and Equipment Corporation, Mishewaka, Ind.

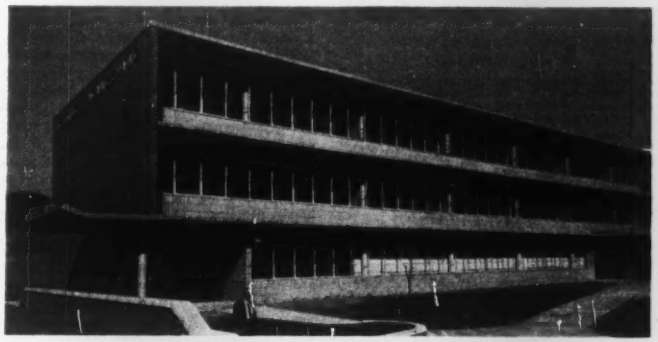
12:15 p.m.

Management Luncheon

Presiding: *Frank H. Neely*, chairman of the board, Rich's Inc. and chairman, board of directors, Sixth District Federal Reserve Bank, Atlanta, Ga. and *Cherry L. Emerson*, vice-president, Georgia Institute of Technology, Atlanta, Ga.

Speaker: *Frank Farrier Groseclose*, director, School of Industrial Engineering, Georgia Institute of Technology, Atlanta, Ga.

Subject: **The Importance of Southern Industry to the National Economy**



HARRISON HIGHTOWER TEXTILE ENGINEERING BUILDING AT THE GEORGIA INSTITUTE OF TECHNOLOGY, ATLANTA, GA. THIS 1½ MILLION DOLLAR BUILDING WAS DEDICATED OCTOBER, 1950

Who Becomes an ASME Life Member?

AT THE 1950 Semi-Annual Meeting in St. Louis, Mo., the Council of The American Society of Mechanical Engineers amended the By-Laws and Rules pertaining to life membership, the amendments to become effective on Oct. 1, 1952.

Under the present By-Law, Article B5, Par. 12, which will expire in 1952, it is mandatory for Council to confer life membership on any Fellow, Member, or Associate of the Society (1) when he has paid dues for 35 years, or (2) when he has reached the age of 70 after having paid dues for 30 years.

In the amended By-Law, it will be mandatory for Council to confer life membership only on those Fellows, Members, and Associates who have paid dues for 35 years and who have in addition either reached the age of 65 or have retired from regular work.

Life membership can be purchased at any time by any Fellow, Member, or Associate by paying the Society at one time the present worth of an annuity equal to that member's dues for the period for which he is required to pay dues. In most cases this period will be longer under the amended By-Law effective October, 1952, than under the current one.

As in the present By-Law, student membership dues will not be considered as applying to the 35-year-dues payment.

In accordance with the new rule (Article B5 Rule 3) within six months after a Fellow, Member, or Associate has completed 35 years of dues payment, the Society will advise him of the amended life-membership provision and request him to notify the Society when he retires from regular work.

2:30 p.m.

Management (III)

Status of Scientific Management in the Southeast, by *Howard P. Emerson*, professor and head, department of industrial engineering, University of Tennessee, Knoxville, Tenn.

The Role of the Engineer in Area Development, by *Lloyd J. Hughlett*, Arthur D. Little Company, Inc., Cambridge, Mass.

2:30 p.m.

Safety—American Society of Safety Engineers

Panel—Finding The Why of Accidents

7:00 p.m.

Banquet

Toastmaster: *E. W. O'Brien*, vice-president, W. R. C. Smith Publishing Company, Atlanta, Ga.

Invocation: *Blake R. Van Leer*, president, Georgia Institute of Technology, Atlanta, Ga.

Speaker: *William H. Ruffin*, president, National Association of Manufacturers.

THURSDAY, APRIL 5

9:30 a.m.

Management (IV)

The Application of Statistical Techniques in Time Study, by *George Wilkinson*, director of research, Paul B. Mulligan and Company, New York, N. Y.

Optimum Speeds of Translation and Rotation for the Visual Inspection of Cylindrical Surfaces, by *E. Paul DeGarmo*, professor; *E. C. Keachie*, associate professor, department of mechanical engineering, University of California, Berkeley, Calif.; and *A. L. DeHart*, instructor, Monterey Peninsular College, Monterey, Calif.

9:30 a.m.

Materials Handling (II)

Economics of Material Handling, by *John B. Day*, professor, Georgia Institute of Technology, Atlanta, Ga.

Application of Conveyer to Coal-Mining Operations, by *George B. Maples*, sales engineer, industrial division, Continental Gin Company, Birmingham, Ala.

Region VIII to Hold Annual Meeting in Kansas City, April 16–18

REGION VIII of The American Society of Mechanical Engineers will hold its second purely regional meeting at the President Hotel, Kansas City, Mo., April 16–18, 1951. The meeting will be preceded by the Region VIII Regional Administrative Committee Meeting at which two delegates each from Sections in Region VIII will meet to discuss a variety of problems pertaining to Society administration.

The program will include technical sessions at which ten papers of interest to Midwestern engineers will be presented, a social program, and inspection trips.

The following technical papers will be presented:

Challenge to Engineers, by *Forrest Nagler*, chief mechanical engineer, Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

Research and the Development of Resources, by *C. N. Kimball*, president of Midwest Research Institute.

Design of a Modern Steam-Electric Station, by *R. D. Woodson*, Black and Veatch, Kansas City, Mo.

Professional Unity and Social Responsibility of Engineers, by *H. Lee Norris, Jr.*, Fish Constructors, Inc., Houston, Tex.

Burners for Liquid and Gaseous Fuels, by *Otto de Lorenzi*, director of education, Combustion-Engineering Superheater, Inc., New York, N. Y.

A Study in Black, by *R. P. Vail*, chief engineer, Cabot Carbon Company, Pampa, Tex.

Measurement and Elimination of Unusual Vibration in the Blading of a Large Slow-Speed Hydraulic Turbine, by *John Parmakian*, Bureau of Reclamation, Denver, Colo.

The Boeing Gas Turbine, by Boeing Aircraft Company.

Welding, Stress Relieving, and Field Testing of High-Temperature, High-Pressure Piping, by *Howard Simms*, Flint Steel Corporation, Tulsa, Okla.

Statistical Analysis, a Powerful Tool for Engineers, by *Allen R. Deschere*, University of Colorado, Boulder, Colo.

The Region VIII Student Conference will be held simultaneously with the Region VIII meeting. Student delegates will be invited to attend luncheons and technical sessions.

The social program will get under way with a joint student-member luncheon on Monday, April 16. Carl Eckhardt, vice-president, Region VIII, will be the keynote speaker. On Monday afternoon a cocktail party followed by a buffet dinner is scheduled. Students will be awarded prizes for winning papers and these papers will be read.

The following persons are in charge of the meeting: General chairman, Chester Cotter; vice-chairman and secretary, C. E. Brown; meetings and papers, R. P. Hahn; hotel, E. M. Bruzelius; registration, Newby Miller; entertainment, T. C. Cheasley; inspection trips, E. L. McDonald; publicity, Martin Goland; finance, L. F. Mart; student activities, C. R. Green; and ladies program, Mrs. T. C. Cheasley.

Two-Day Program Set for 1951 Pittsburgh Mechanical Engineering Conference

PITTSBURGH Engineering Accomplishments" will be the theme of the 1951 Mechanical Engineering Conference sponsored by the Pittsburgh Section of The American Society of Mechanical Engineers in co-operation with other Pittsburgh chapters of national professional societies. The conference will be held at the William Penn Hotel, Pittsburgh, Pa., April 19–20, 1951. It will cover recent developments in mechanical engineering which have taken place in Pittsburgh and will honor prominent engineers resident in the Pittsburgh area.

The five professional societies whose Pittsburgh sections are sponsoring technical papers are: American Society of Lubricating Engineers, Engineers Society of Western Pennsylvania, American Society of Heating and Ventilating Engineers, American Materials Handling Society, and the American Society of Refrigerating Engineers.

A number of rooms have been reserved at the William Penn Hotel for out-of-town members attending the conference. For reservations write to K. F. Treschow, Engineers Society of Western Pennsylvania, William Penn Hotel, Pittsburgh, Pa.

J. Calvin Brown, president ASME, will be honored guest and speaker at the dinner on Thursday, April 19.

This year the Pittsburgh Section is setting a precedent inviting members of the ASME Woman's Auxiliary and wives of members to the conference dinner.

The technical program follows:

THURSDAY, APRIL 19

Morning

Heating

Design of the Heating and Ventilating System for the Greater Pittsburgh Airport, by *T. F. Rockwell*, consulting engineer, Pittsburgh, Pa.

Aluminum Panels for the Cooling and Heating of Buildings, by *B. R. Small*, staff mechanical engineer, Aluminum Company of America, Pittsburgh, Pa.

AERIAL VIEW OF BALTIMORE, MD., WHERE THE ASME PROCESS INDUSTRIES DIVISION WILL HOLD ITS SECOND ANNUAL CONFERENCE, APRIL 17–19, 1951

Mechanical Construction

Interesting Aspects of Several Recent Construction Jobs, by *H. G. Dillon*, Heyl & Patterson Company, Pittsburgh, Pa.

Afternoon

Refrigeration

Wind Tunnels, Their Design and Equipment, by *J. O. Jackson*, Pittsburgh Des Moines Steel Company, Pittsburgh, Pa.

Turboexpanders for Refrigeration, by *Harry Kottas*, chief, mechanical division, Lewis Flight Propulsion Laboratory, National Advisory Committee for Aeronautics, Cleveland, Ohio.

Metalworking Session

Evening

Dinner

Speaker: *J. Calvin Brown*, president ASME.

FRIDAY APRIL 20

Materials Handling

Materials Handling in the Dravosburg Plant of Fisher Body Company, by *Anthony Stormzand*, plant manager, Fisher Body Company, Dravosburg Works, Dravosburg, Pa.

Materials Handling for a Modern Open-Hearth Furnace, by *D. R. Loughrey*, superintendent, open hearths, Jones and Laughlin Steel Company, Pittsburgh, Pa.

Metal Surfacing

The Preparation of Metal Surfaces to Be Painted, by *A. J. Liebman*, director of research, Dravo Corporation, Pittsburgh, Pa.

Afternoon

Power

The Elramus Power Station, by *W. H. Jones*, mechanical engineer, Duquesne Light Company, Pittsburgh, Pa.

Locomotive Power in Pace With the Changing Times, by *Charles Kerr, Jr.*, consulting engineer, Westinghouse Electric Corporation, East Pittsburgh, Pa.

Lubrication

The Design and Lubrication of Bearings, by *John Boyd*, Westinghouse Electric Corporation, East Pittsburgh, Pa.

Extreme-Pressure Lubricants, by *J. H. Lewis*, superintendent of maintenance, Clairton Works, U. S. Steel Corporation.

Inspection Trip

The Fisher Body Plant, Dravosburgh, Pa.

Process Industries Conference to Take Up Industrial Pollution

THE fact that the engineering profession accepts responsibility for pollution of industrial air and water resources is evident from the excellent program planned for the second annual conference of the Process Industries Division of The American Society of Mechanical Engineers. The conference will be held at the Lord Baltimore Hotel, Baltimore Md., April 17–19, 1951.

The titles of the papers reflect a confidence in the ability of engineers to solve pollution problems, and indicate that techniques are on file and instruments are available to do the job when public interest is prepared to meet the cost.

The conference will consist of six technical sessions at which 14 papers will be discussed, social events held, and inspection trips taken to Baltimore's industrial establishments.

A. G. Christie, professor-emeritus of mechanical engineering, The Johns Hopkins University in Baltimore, will set the keynote for the conference at the first session when he takes up "Air Pollution as a Problem of the Process Industries." Another authority in the field of air pollution who will participate in the conference is William F. Bryne, consulting engineer, Byrne Associates, New York, N. Y. Mr. Byrne, who was called upon last year by New York City to organize its smoke-abatement program, will speak on problems encountered in establishing air-pollution control for large cities.

A registration fee of $2 to members and $4 to nonmembers will be charged. The fee will entitle registrants to copies of all available preprints. Dues for students who are not ASME members will be $1.

The Process Industries Division's first national conference was held in Pittsburgh in 1950. The success of this event revealed wide interest among mechanical engineers for a program to funnel into the literature, technical papers on problems confronting engineers in process industries not already covered by other professional divisions of the ASME.

The Division was organized in 1934 and currently has a membership of 3000 engineers operating and designing mechanical equipment for such industrial processes as air conditioning, refrigeration, evaporation, drying, sanitation, and others. Mechanical engineers working with these industrial processes who are not yet affiliated with the Division are invited to participate in the Division's activities. More information can be obtained by writing to J. B. Chamberlain, Chilean Nitrate Sales Corporation, 120 Broadway, New York 5, N. Y.

Arrangements for the conference are in charge of S. B. Sexton, chairman, Arthur Gompf and Harland Hyde, of the ASME Baltimore Section, and J. H. E. Fedeler, chairman, E. L. Knoedler and L. A. Dorgan, of the ASME Process Industries Division.

The tenative program follows:

TUESDAY, APRIL 17

9:30 a.m.

Registration

12:30 p.m.

Welcome Luncheon

Presiding: *Samuel B. Sexton, 3rd*, chairman, ASME Baltimore Section.
Speaker: *Paul L. Holland*, director of Public Works, City of Baltimore.

2:30 p.m.

Session I

Air Pollution—A Problem of the Process Industries, by *A. G. Christie*, professor emeritus, mechanical engineering, The Johns Hopkins University, Baltimore, Md.

Electrostatic Precipitation of Gases, by *W. F. Perkins*, vice-president, The Johns Hopkins University, Baltimore, Md.

8:00 p.m.

Session II

Automatic Recording and Control as Applied to Same Industrial Pollution Problems, by *W. N. Greer* and *R. K. Davis*, Leeds & Northrup Company, Philadelphia, Pa.

Flow-Metering Equipment for Measuring Industrial Wastes, by *G. Newberg*, design engineer, Minneapolis-Honeywell Regulator Company, Philadelphia, Pa.

WEDNESDAY, APRIL 18

9:30 a.m.

Session III

Control of Pollution in the Port of Baltimore, by *T. D. Conn*, deputy harbor engineer, Bureau of Harbors, Baltimore, Md.

Problems Encountered in Establishing Air-Pollution Control for a Large City, by *William F. Byrne*, consulting engineer, Byrne Associates, New York, N. Y.

2:30 p.m.

Session IV

Industrial Fume and Chaff Incineration, by *Joseph L. Kopf*, president, Jabez Burns & Sons, Inc., New York, N. Y.

Hooker Electrochemical Company's Air-Pollution Abatement Activity, by *K. F. Schulis*, Hooker Electrochemical Company, Niagara Falls, N. Y.

Session V

Drying and Atmosphere Air Pollution, by *A. M. Lane*, chemical engineer, Wyssmont Company.

Protection of Closed Vessels Against Internal Explosions, by *A. L. Brown*, chief engineer, Factory Mutual Engineering Division, Boston, Mass.

Water Pollution—A Survey of State Legislation, by *D. F. Othmer*, head, chemical engineering department; and *M. D. Weiss*, research associate, Brooklyn Polytechnic Institute, Brooklyn N. Y.; and *Robert S. Aries*, consulting engineer, R. S. Aries Associates, New York, N. Y.

7:00 p.m.

Banquet

Presiding: *J. H. E. Fedeler*, chairman, ASME Process Industries Division.

Toastmaster: *A. G. Christie*, honorary member and past-president ASME

THURSDAY, APRIL 19

9:30 a.m.

Session VI

The Utilization of Pollutive Wastes in the Process Industries, by *D. F. Othmer*, head, chemical engineering department; and *Marvin D. Weiss*, research associate, Brooklyn Polytechnic Institute Brooklyn, N. Y.; and *Robert S. Aries*, consulting engineer, R. S. Aries Associates, New York, N. Y.

Restoration of the Schuylkill River, by *Frederick H. Dechant*, consulting engineer, Phila., Pa.

How Industry Can Aid to Prevent Stream Pollution, by *E. B. Besselievre*, chief sanitary engineer, The Dorr Company, Stamford, Conn.

2:30 p.m.

Plant Trips

Lever Brothers Company
American Radiator & Standard Sanitary Corporation.

ASEE-ASME Summer School to Be Held June 28–July 7

A THERMODYNAMICS summer school for mechanical-engineering teachers will be held at Michigan State College, East Lansing, Mich., June 28–July 7, 1951. The school is being sponsored by the American Society for Engineering Education and The American Society of Mechanical Engineers.

The purpose of the school is to help teachers in the field of thermodynamics. A dual program will be presented. The school will take up, first, new and improved teaching techniques of elementary concepts in thermodynamics, and second, will provide background material on new developments and advanced theoretical work being done in the field.

A registration fee of $10 will be charged. Cost of meals and housing for the period is estimated at $50 per person. The tentative program follows:

Thursday, June 28: Leading the student of thermodynamics to think, teaching the concept of state properties, boundaries, systems, etc.

Friday, June 29: First law of thermodynamics, effective presentation and modern approach to the second law of thermodynamics, energy transfer from the laws of thermodynamics, fluid mechanics, and thermodynamics.

Saturday, June 30: Availability and reversibility, mathematical approach to kinetic theory of gases, and kinetic theory of gases and thermodynamics.

Monday, July 2: Basic physical chemistry for thermodynamics teachers, physical chemistry and the first and second law of thermodynamics, integration of the physical chemistry approach to thermodynamics.

Tuesday, July 3: Visual aids in teaching thermodynamics; atomic age: how to equip engineering students for it; thermodynamics of gasoline-engine cycles.

Wednesday, July 4: Thermodynamics of vapors, preparation of vapor tables.

Thursday, July 5: Combustion theory, combustion in stationary boilers, steam turbines, and power-plant design.

Friday, July 6: Theory of jet engines, combustion in jet engines.

Saturday, July 7: Gas-turbine design, compressor design, compressible flow.

AT THE 45TH ANNUAL REUNION DINNER OF THE ASME MEETINGS COMMITTEE

(*Left to right, rear row:* O. B. Schier, Edward S. Rowell, Henry J. Scagnelli, Glenn R. Fryling, Robert C. Spencer, G. A. Stetson, Ernest Hartford. *Middle row:* R. F. Gagg, J. Keith Louden, Richard A. North, C. E. Davies, R. H. Bacon, Roland W. Flynn. *Front row:* Glenn B. Warren, Arthur L. Williston, A. W. Thorson, Dexter S. Kimball, Erik Oberg.)

ASME Meetings Committee Holds 45th Annual Reunion Dinner

THE Meetings Committee of The American Society of Mechanical Engineers held its forty-fifth annual reunion dinner at the Engineers' Club, New York, N. Y., on Jan. 17, 1951. Former and present members of the committee, including four members of the Secretary's staff, were present at the dinner. A. W. Thorson, chairman of the committee, presided, and Glenn B. Warren, chairman in 1949, was the guest of honor.

Reunion dinners, which are observed by a number of ASME standing committees, were initiated by the Meetings Committee as a means of honoring retiring chairmen after years of faithful service. They afford an opportunity for former and present members of the committee to get together and discuss long-range plans and renew long-standing friendships established during their years of service on the committee.

Present at the 1951 dinner were the following former chairmen of the committee: Arthur L. Williston (1905), Dexter S. Kimball (1919, 1920), R. F. Gagg (1939, Mr. Gagg was the first junior advisory member of the committee, serving in that capacity from 1932–1935), Erik Oberg (1940), Richard A. North (1946), and Glenn B. Warren (1949). Members of the present committee in attendance at the dinner were A. W. Thorson, R. H. Bacon, J. Keith Louden, and Roland W. Flynn. The following junior advisory members were present: Edward S. Rowell (1945–1946), Henry J. Scagnelli (1947–1949), Robert C. Spencer (1949–1950), and Glenn R. Fryling (1950–1951). Members of the staff present were: C. E. Davies, Ernest Hartford, George A. Stetson, and O. B. Schier, 2nd.

Questionnaire Helpful in Program Planning

WHEN the Rochester Section of The American Society of Mechanical Engineers wanted to know what kind of program its members desired for 1950–1951, Section officers resorted to an old idea. They asked each member what kind of ASME activities he wanted. The results were surprising. For example, the members, four to one, asked for an ASME civic affairs committee and about 50 per cent of those answering the questionnaire volunteered to serve.

Also shattered was the general feeling among Section leadership that ASME members in Rochester were little interested in the administrative details and other matters associated with the management of a professional society. Rochester members, five to one, voted that the Section should devote one meeting annually entirely to ASME affairs. According to Phillip M. Kimmell, chairman, Rochester Section, it has been the practice for years to hold all section meetings jointly with the Rochester Engineering Society. At such meetings no discussion was practicable on local or national ASME matters. These

were traditionally left to the Section executive committee.

The questionnaire also uncovered a revived interest in social activities. Such activities had formerly been a standard element in Section programs but had been discontinued because of lack of support. On the basis of a five-to-three vote in favor of social events, the Section has organized a new social committee and is planning a stag social meeting in the spring.

The Civic Affairs Committee organized as result of the questionnaire set out immediately to make the services of Rochester engineers available to city authorities. One of its first actions was to sponsor a meeting at which Karl B. McEachron, Jr., of General Electric Company, Schenectady, N. Y., spoke on "Civic Responsibility Is Everybody's Business Now." The committee submitted its comments on Rochester's proposed smoke ordinance. It participated in the organization of and sent delegates to the Architect's and Engineer's Joint Council on Civic Affairs. The committee has under way plans for an evening meeting at which Carey Brown, Eastman Kodak Company, Rochester, N. Y., will discuss the report on National Water Policy of the EJC. The enthusiasm for the committee's program and the success with which it was carried out resulted in its establishment as a permanent committee.

The questionnaire, which was dated July 28, 1950, contained questions on matters of policy and asked members whether they would serve on Section committees. The large number of volunteers for committee work enabled Rochester officers to select committee personnel from a list of volunteers, many of whom had not served previously but who were eager to help, instead of having to depend on acquaintances.

The Rochester Section's highly satisfactory results from the summer questionnaire points up a sound preliminary step in program planning.

Actions of the ASME Executive Committee

At a Meeting at Headquarters, Jan. 23, 1951

A MEETING of the Executive Committee of the Council was held in the rooms of the Society on Jan. 23, 1951. J. Calvin Brown, chairman, presided. In addition to Mr. Brown there were present: Frank M. Gunby, vice-chairman; A. C. Pasini, William M. Sheehan, of the Executive Committee; H. E. Whitaker, Finance Committee, E. G. Bailey, past-president, H. R. Kessler, vice-president, H. E. Martin, director at large, C. E. Davies, secretary, and Ernest Hartford, executive assistant secretary.

ECPD Training Program

Upon recommendation of the Finance Committee, an appropriation from the Development Fund was voted for support of the proposed training program of the Engineers' Council for Professional Development. The ECPD program called, "The First Five Years of Professional Development," has been developed by the ECPD Professional Training Committee. The program's objective is to improve engineering education during the early postcollege years.

Sixty-Five-Year Members

Special certificates were approved for the following members who will mark their 65th year of ASME membership in 1951: M. A. Beck, Milwaukee, Wis.; H. B. Gale, Natick, Mass., and W. M. Whitney, Winchendon, Mass.

ASME Research

Upon recommendation of the Research Committee, agreement by the ASME and the Ohio State University Research Foundation was extended through Sept. 30, 1951. The agreement pertains to determination of discharge coefficients of eccentric and segmental orifices.

1950 Annual Meeting

A resolution of thanks expressing appreciation on behalf of the Society to all who contributed to the success of the 1950 Annual Meeting was adopted.

Section Boundary Changes

Upon recommendation of S. H. Graf, vice-president, ASME Region VII, and with the consent of the Sections involved, the following changes were made to Section boundaries:

Western Washington: All the counties in Washington lying west of the summit of the Cascade mountains, and north of the northern boundaries of Wahkiakum, Cowlitz, Skamania, and Klickitat counties.

Oregon: All of the State of Oregon, plus the following counties in the State of Washington: Wahkiakum, Cowlitz, Skamania, and Klickitat.

Inland Empire: All the counties in Washington lying east of the Cascade mountains, plus the following counties in northern Idaho; Boundary, Bonner, Kootenai, Benewah, Latah, and Nezperce.

New Subsection

Upon recommendation of A. C. Pasini, vice-president, ASME Region V, the establishment of the Central Michigan Sub-Section of Detroit was approved.

Unity Conference

Following review of the report submitted by the Exploratory Group on Unity of the Engineering Profession, the Committee voted to transmit the report to all ASME Sections with the request that it be studied carefully by the executive committee of each Section and that Section delegates to the Regional Administrative Committee meetings come prepared to express a preference for one of the four plans described in the Unity Report. (For a description of the four plans see pages 254–255 of this issue.)

The Committee also asked that the Regional Administrative Committees in turn correlate their views for presentation at the Regional Delegates Conference, so that a report can be submitted to Council at its Semi-Annual Meeting in June, 1951.

Mexico Group

Consideration was given to a request from the ASME Mexico Group that some consideration be made to ASME members resident in Mexico because of the exchange difference. The committee reviewed policies of other Founder Societies and agreed to make no change in present ASME Society policy of no dues concessions to members resident in other countries.

Service to Members

In view of the increase in Society dues, it was agreed to appoint a planning committee to review ASME objectives, organization, and what changes, if any, were needed in organization structure and long-term objectives.

Student Branches

Upon recommendation of J. T. Rettaliata,

ASME Calendar of Coming Events

April 2–5
ASME Spring Meeting, the Atlanta Biltmore, Atlanta, Ga.
(Final date for submitting papers was Dec. 1, 1950)

April 16–18
ASME, Region VIII, Annual Meeting, Hotel President, Kansas City, Mo.

April 17–19
ASME Process Industries Division Conference, Lord Baltimore Hotel, Baltimore, Md.
(Final date for submitting papers was Dec. 1, 1950)

June 11–15
ASME Semi-Annual Meeting. Hotel Royal York, Toronto, Ont., Can.
(Final date for submitting papers was Feb. 1, 1951)

June 22–23
ASME Applied Mechanics West Coast National Conference, Stanford University, Stanford, Calif.
Submit papers through J. N. Goodier, Division of Engineering Mechanics, Stanford University)

June 25–29
ASME Oil and Gas Power Division Conference Baker Hotel, Dallas, Texas
(Final date for submitting papers was Feb. 1, 1951)

Sept. 10–14
ASME Industrial Instruments and Regulators Division and Instrument Society of America Exhibit and Joint Conference, Houston, Texas
(Final date for submitting papers—May 1, 1951)

Sept. 24–26
ASME Petroleum Mechanical Engineering Conference, Hotel Mayo, Tulsa, Okla.
(Final date for submitting papers—May 1, 1951)

Sept. 25–28
ASME Fall Meeting, Hotel Radisson, Minneapolis, Minn.
(Final date for submitting papers—May 1, 1951)

Oct. 11–12
ASME Fuels and AIME Coal Divisions Joint Conference, Hotel Roanoke, Roanoke, Va.
(Final date for submitting papers—June 1, 1951)

Nov. 25–30
ASME Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.
(Final date for submitting papers—July 1, 1951)
(For Meetings of Other Societies see page 261)

vice-president, ASME Region VI, the establishment of a student branch at the South Dakota School of Mines and Technology, Rapid City, S. D., was approved.

Certificates of Award

Certificates of Award were approved for the following:

George Henderson, honorary chairman, Syracuse University Student Branch for three years ending September, 1950.

Retiring Chairmen of Sections: Frederick F. Borries, Cincinnati Section; E. H. Garrett, Green Mountain Section.

Retiring Chairmen of Boards and Committees: F. S. Blackall, jr., Board on Codes and Standards; W. G. Christy, Engineers Registration Committee; A. M. Gompf, Board on Membership; H. E. Martin, Organization Committee; R. H. McLain, Admissions Committee; F. K. Mitchell, Standardization Committee; James W. Parker, Board on Education and Professional Status; C. B. Peck, Lectureships Committee; L. C. Smith, Constitution and By-Laws Committee; R. B. Smith, Publications Committee; J. J. Zeitner, Safety Committee.

Retiring Chairmen and Members of Professional Divisions Executive Committees: G. T. Abernathy, Hydraulic Division; K. A. Browne, Gas Turbine Power Division (member) Railroad Division; Colin Carmichael, Machine Design Division; E. W. Jacobson, Petroleum Division; E. R. Kaiser, Fuels Division; R. P. Kroon, Applied Mechanics Division; H. B. Maynard, Management Division; H. F. Moore, Industrial Instruments and Regulators Division (member); C. R. Nichols, Wood Industries Division; L. B. Schueler, Heat Transfer Division (member); F. W. Warner, Rubber and Plastics Division; J. B. Webb, Materials Handling Division; J. I. Yellott, Power Division (member).

Engineering Manpower Commission

Following a report by E. G. Bailey, temporary chairman of the Engineering Manpower Commission of the Engineers Joint Council, it was voted to approve the statement of purpose, program, and organization, and the budget of the Engineering Manpower Commission as approved by the EJC, and to study the matter of allocation of a sum from the development fund to support the program. The Committee also approved the request of the EJC to have C. E. Davies, secretary ASME, to serve as director of the Engineering Manpower Commission program.

Interchange of Information

The Committee approved a request for the interchange of information on definitions of terms "professional engineer" and "technician" and on engineering abstracting services among engineering groups in Western Europe, the United States, and the British Commonwealth.

U. S. Military Academy

ASME participation in the sesquicentennial anniversary of the U. S. Military Academy, West Point, N. Y., January to June, 1952, was approved.

ASME Standards Workshop

Lantern Slides

AN important step toward revision of the 1932 American Standard on Engineering and Scientific Charts for Lantern Slides Z15.1 was taken recently when a questionnaire was sent to 100 organizations who use lantern slides or similar projection media asking for information that might be useful in revising the standard.

The first part of the questionnaire, designed to obtain experience data, referred to an article on "Preparation of Effective Lantern Slides," by L. S. Bonnell, chairman, Subcommittee 1 on Lantern Slides, which was published in the Sept. 12, 1949, issue of *Chemical and Engineering News*.

In undertaking the revision the subcommittee was especially concerned about the apparent lack of standardization in projection conditions encountered in practice.

One of the questions relating to this phase of the problem asked users whether they commonly encounter an auditorium projection condition in which the distance from the back row of the audience to the projection screen was more than the recommended distance of six times the maximum projection width. Another question referred to the size of slides or film strips customarily used.

The second part of the questionnaire asked for suggestions on coverage of the proposed revision. Users were asked to rate the importance of the following items: Tips on the psychology of effective presentation; legibility distances for original copy and finished slides; list of precautions which a speaker should observe in using slides; preferred materials and suggested drafting techniques; and a preferred process for preparing lantern slides from photograph prints or micrographs. The revision is to include standards for the preparation of colored slides.

Elevators

A COMPLETE revision of American Standard Safety Code for Elevators, Escalators, and Dumbwaiters A17.1 has been under way for three years. Seven months ago work schedules were accelerated in order to complete the draft of the three-part proposed revision for consideration by the Sectional Committee in June, 1951. Some 20 subcommittees are engaged in this activity. For the past several months A17 subcommittees have occupied the ASME board room for three to five consecutive days each month. Simultaneous meetings have often been scheduled.

The revised code will have three parts divided into (1) general requirements for elevators; (2) private residence elevators; and (3) escalators. The section on escalators was completed and approved in December, 1950. A draft of the section on private-residence elevators is now before industry for comment. A draft of Section I, which is the largest, is rapidly nearing completion.

Revision of the standard is under the supervision of G. P. Keogh, supervising industrial code referee, New York State Department of Labor, New York, N. Y., chairman of Sectional Committee A17. Mr. Keogh, who assumed the chairmanship seven months ago, has been a member of the Sectional Committee for more than 15 years. Since 1946 he has been chairman of the Executive Committee.

Pressure Piping

THE SECTIONAL Committee on Safety Code for Pressure Piping B31 approved a revision of the code for pressure piping last month. The revised code brings up to date the 1942 issue. Its supplements 1 and 2 were issued in 1944 and 1947, respectively.

The revised code allows for new materials capable of meeting industrial requirements for pressure piping. Copies of the code will soon be off the press and may be obtained from the ASME Order Department, 29 West 39th Street, New York, N. Y. Price per copy $3.50.

Awaiting Approval

WORKING committees have under consideration drafts of the following codes and standards which should be approved within the next six months: Inserted Blade Milling Cutters; Square and Hexagon-Head Bolts and Nuts; Accuracy of Engine and Tool Room Lathes; Safety Code for Elevators; Wrought Copper and Bronze Fittings; Steel Pipe Flanges and Fittings; Screw Thread Gages and Gaging; Acme Screw Threads; Stub Acme Screw Threads; Buttress Threads; Microscope Objective Threads; Surveying Instrument Mounting Threads; Gas Turbines; Displacement Compressors; Vacuum Pumps and Blowers; Steam Condensing Apparatus; Centrifugal Pumps; Evaporating Apparatus; Atmospheric Water Cooling Equipment; and Feedwater Heaters.

Building Code Conference

A NEW York State Building Code Conference was held in the rooms of the ASME on Feb. 20, 1951. Attended by representatives of technical societies, trade associations, municipal authorities, and manufacturers of building materials, the conference considered the drafting of a New York State building-code law. The purpose of the proposed legislation is to provide a law which will encourage basic and uniform building-code standards among New York communities, incorporate modern methods of construction and new materials, and encourage new techniques as they become available.

If agreement can be reached on a new law, the general public will benefit from lower costs of building materials currently unnecessarily high because of lack of standardization. The new law will also eliminate obsolete municipal codes which are greatly inhibiting

use of newly developed methods and materials which make construction cheaper without sacrifice of safety.

Rivets

SINCE the publication of Large Rivets (ASA B18.5–1950) the following errors have been brought to the attention of The American Society of Mechanical Engineers:

Page 11, Table 8 on Button Head, rivet dimension H′ for the $^1/_2$ in. diameter should be 0.312.

Page 14, Table 11 on Pin Head, rivet dimension A for the $1^1/_2$ in. diameter should be 2.516.

ASME Student Members Prepare for 1951 Conferences

SOME 130 student branches of The American Society of Mechanical Engineers are currently grooming their ablest speakers for the papers competitions which are held annually at the 12 Regional Student Conferences.

Last year the conferences attracted more than 2400 students whose interest and enthusiasm for the engineering profession was amply demonstrated in the high caliber of the prize-winning papers.

The conferences are held at engineering schools centrally located so as to minimize the distance students must travel to attend. In the East where the ASME Regions are relatively small, each Region holds one conference. In the Far West and Southwest, however, where distance imposes travel hardship, two or three conferences are held. Intended as a climax for the student-branch scholastic year, the conferences are usually held in April or May. This year, however, the Region VIII (Southern Tier) conference got off to an early start by meeting at Louisiana State University, Baton Rouge, La., in February. Location of the other conferences are listed elsewhere on this page.

In general, student conferences follow the pattern of Society national meetings. There is a registration period, two or more technical sessions during which the papers competition is held, a get-together luncheon, and a dinner. A dance in the evening completes a full day for conference delegates.

The strong interest in young engineers so evident in the ASME provides the conferences with ample support. Travel expenses of students are defrayed in part by an allowance per Section of 16 cents a mile for the distance between the student branch and the place of the conference. The Society also grants each conference $100 in prize money to add zest to the competitions. The host student branch in co-operation with ASME Sections in the vicinity of the conference often arranges special inspection trips at which delegates are entertained by local industry. The Old Guard of the Society also contributes $10 in prize money to each conference.

ASME members who serve as judges for the competitions find inspiration in this work. The comment is often made that the presentation of student papers sets a standard unmatched by authors at Society national meetings.

(For précis of prize winning papers at the 1950 Student Conferences, see pages 851–854 of the October, 1950, issue of MECHANICAL ENGINEERING.)

Junior Forum

What to Do About the Draft

Experts Answer National Junior Committee Questions

TO aid young engineers in the draft-age group who are presently facing career decisions, the National Junior Committee of The American Society of Mechanical Engineers, at its regular meeting on Jan. 13, 1951, asked three questions of the Engineering Manpower Commission of the Engineers Joint Council. The questions were so framed that replies coming from authorities in engineering training, well informed on the present manpower shortage, would be helpful to young engineers in the following situations: (1) The engineering student who is wondering whether he had better not enlist immediately; (2) The reserve officer who knows he will be called up soon and who wants to be certain that his duties in the Armed Forces will be of an engineering nature; (3) The young engineer in a nonessential industry who is loyal to his employer but wants to serve his country in the best way possible.

Replies were received from M. M. Boring, manager, Technical Personnel Division, General Electric Company, Schenectady, N. Y., and advisory member, ASME Education Committee; and from H. N. Muller, assistant to vice-president, Westinghouse Electric Corporation, Pittsburgh, Pa., and secretary, ECPD Training Committee.

The Engineering Student

The questions and replies follow:

1 As an engineering student should I enlist now or should I continue my education?

Mr. Boring: I am convinced that it is the duty, considering the extremely short supply of engineers that will be with us in the next several years, for every student to go as far as he can and do the best he can. Certainly no young man can make a better contribution than to prepare himself for increased responsibilities.

Mr. Muller: If an engineering student has wholly satisfactory grades, and is convinced of his ability to graduate in good standing, he should continue his education rather than enlist. This opinion is based upon the fact that our country is currently critically short of engineers and that enlistment of well-

1951 ASME Regional Student Conferences

Region	*Host*	*Place*	*Date*
I New England	University of Vermont	Burlington, Vt.	April 20–21
II Eastern	Stevens Institute of Technology	Hoboken, N. J.	May 5
III Alleghenies	University of Pennsylvania	Philadelphia, Pa.	April 20–21
IV Southern	Georgia Institute of Technology (In conjunction with Spring Meeting April 1–5)	Atlanta, Ga.	April 2
V Midwest	University of Detroit	Detroit, Mich.	April 30–May 2
VI Northern Tier	Illinois Institute of Technology	Chicago, Ill.	May 7–8
VI Southern Tier	University of Illinois	Peoria, Ill.	April 26–27
VII Pacific Northwest	Oregon State College	Corvallis, Ore.	May 3–5
VII Pacific Southwest	University of Southern California	Los Angeles, Calif.	April 20–21
VIII Northern Tier	Junior Engineers' Club of Kansas City	Kansas City, Mo.	April 16–17
VIII Southern Tier	Louisiana State University	Baton Rouge, La.	February 23–24
VIII Rocky Mountain Tier	University of Wyoming	Laramie, Wyo.	April 27–28

qualified college students is a serious threat to compounding this shortage. Most of those well informed on the current thinking in Washington believe that well-qualified engineering students will be protected from military call in order to complete their specialized education. These informed people further believe that upon graduation, such qualified specialists will be utilized in the necessary civilian or military economy in occupations consistent with their training. Immediate enlistment to prevent future draft is a panic measure, not a rational decision.

The Reserve Officer

2 As a reserve officer, are there any steps I can take to make certain that my duties in the Armed Forces will be of an engineering nature?

Mr. Boring: It has been my experience that the Armed Forces are trying to utilize education and experience as best they can. I am convinced there is no deliberate waste of manpower. It has been our experience so far with reservists calls that many have had the opportunity of shifting to positions more in the line of their education and experience. Of course, the Armed Forces are primarily looking for specialists at the present time and the specialization may have some engineering content. It is most difficult for line officers, whether in the enlisted or officer reserve, to make shifts. We must recognize, of course, that in training a very large number of completely untrained troops that line officers are needed. I would say, in general, however, that the opportunity for a complete shift of activity is not as easy to accomplish as we would like to see it.

Mr. Muller: As a reserve officer, there are no sure steps you can take to make certain that your duties in the Armed Forces will utilize your education and experience. You can, however, inform your Area Command of your recent specialized education and of your job experience in order that all those who may be responsible for your military activities will have full information at their disposal. Many of us believe that poor utilization of engineers by the military is partially caused by lack of current information on the reservist's qualifications. In some instances it may be advisable to request your employer to direct correspondance to the proper military authorities further informing and urging that your technical talents be utilized.

In a Nonessential Industry

3 As an engineer working in a nonessential industry and subject to the draft, what should I do to serve my country most effectively?

Mr. Boring: We must all recognize that in the gray zone of military preparedness the so-called nonessential industries are very apt to be put into full mobilization, and the facilities and manpower of organizations not at the moment directly on war work will probably be partially or completely mobilized in the near future. Under these conditions then it is unwise either for the individual or the Government to strip such facilities of trained manpower as without this manpower, the equipment, buildings, and other facilities are utterly useless. Conditions, I am convinced, will relieve this situation in the relatively near future.

Mr. Muller: If you are an engineer working in a nonessential industry and subject to the draft, you should appraise your own situation very carefully. If you have a keen interest in research, development, and design aspects of engineering, and if you feel you are competent to contribute in these fields, highly essential industry needs you and wants you. Service to your country will very likely be greatest if your talents are thus employed. If, however, you question your analytical technical abilities, or if you have an honest desire to serve in uniform (not based on flag-waving and social pressure), either enlistment or commissioning in the technical branches of the service is admirable.

The Manpower Shortage—An Opportunity and a Challenge

INCREASING concern is being voiced today over the scarcity of men competent to assume executive responsibility in industry. Why? Because the complexity of modern industrial operations demands managers with a high level of technical ability and experience who are also trained to cope with economic and human problems.

Who will fill these jobs? There seems to be only one good answer, inasmuch as a man trained solely on the business side—well versed though he may be in the solution of economic and human problems—stands only a slim chance of acquiring a real understanding of technical problems. The final choice must rest on the engineer, in spite of his reputed absorption with technical problems to the virtual exclusion of other aspects of our industrial economy.

By the very nature of their work engineers are specialists. As Bruce Wallace has pointed out, they have concentrated their efforts on 10 to 15 per cent of the sales dollar—and done a marvelous job of making more goods available at lower costs. But many of them need to broaden their scope and realize the tremendous opportunities that exist for them in the control of that other 85 to 90 per cent of the sales dollar—in top management. No group of people in industry is better trained than the engineers to solve complex problems that require careful analysis, complete understanding, unbiased reasoning, and the ability to express their findings in unmistakable language.

How can an engineer hitherto concerned primarily with technical problems broaden his horizons? Embarking on a campaign of self-education, he can look beyond his concentration on a specialized field, begin to learn about the over-all operation of business in general, and his own company's business in particular—such problems as labor relations, wage incentives, cost control, budget systems, financing, and the essentially human problems of how to keep up production and deliveries in the face of supply and labor difficulties. Complete familiarity with an understanding of these fields plus sound engineering competence and experience add up to an unbeatable combination. With sufficient engineers possessing these assets there should be no difficulty in filling top-management jobs with top-flight managers.

Colin Carmichael.[1]

[1] Member ASME, editor, *Machine Design*, Cleveland, Ohio.

Engineering Societies Personnel Service, Inc.

These items are from information furnished by the Engineering Societies Personnel Service, Inc., in co-operation with the national societies of Civil, Electrical, Mechanical, and Mining and Metallurgical Engineers. This Service is available to all engineers, members or not, and is operated on a nonprofit basis. In applying for positions advertised by the Service, the applicant agrees, if actually placed in a position through the Service as a result of an advertisement, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient nonprofit personnel service and are available upon request. This also applies to registrant members whose availability notices appear in these columns. Apply by letter, addressed to the key number indicated, and mail to the New York office. When making application for a position include six cents in stamps for forwarding application to the employer and for returning when necessary. A weekly bulletin of engineering positions open is available at a subscription of $3.50 per quarter or $12 per annum for members, $4.50 per quarter for nonmembers, payable in advance.

New York, 8 West 40th St. — Chicago, 84 East Randolph Street
Detroit, 100 Farnsworth Ave. — San Francisco, 57 Post Street

MEN AVAILABLE[2]

EXECUTIVE ENGINEER, registered, BSME, BSEE, MSEE, 38, background in manufacturing, sales, application engineering, and management. Desires change for better future opportunity in responsible management position. Me-808.

MECHANICAL ENGINEER, BSME, four years designer milling and mining industry, two years with engines, boilers in merchant shipping. Desires position combining designing with experience in operation, construction, and maintenance work. Me-809.

ENGINEERING EXECUTIVE, 37, married, Cal-Tech graduate, 15 years' experience. Eight years metalworking and tool industry as chief engineer and manager in charge production, engineering, and sales. Extensive carbide-tool and manufacturing experience. Servomechanism and automatic machine-tool contour-system development. Desires responsible management or engineering position. Me-810.

INDUSTRIAL ENGINEER, P.E., 32, married, doctorate, IE, 1949; BChE, 1939. 12 years' diversified experience in management, production, cost and quality control, motion study layout. New York area. Me-811.

POSITIONS AVAILABLE[2]

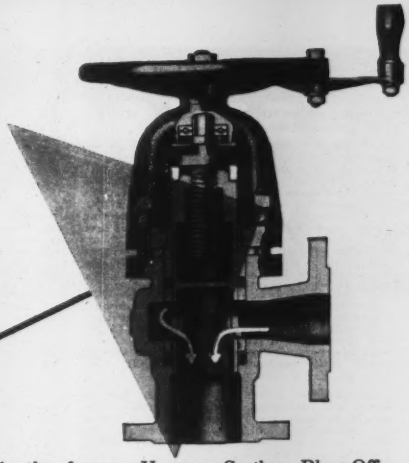
ENGINEERS. (*a*) Mechanical engineer for developmental and test work on chemical-handling equipment such as pumps, valves, pressure recorders. Should have basic knowledge of electrical engineering. (*b*) Mechanical engineer for design, test, and analysis of results of high-output combustion equipment. Two years'

[2] All men listed hold some form of ASME membership.

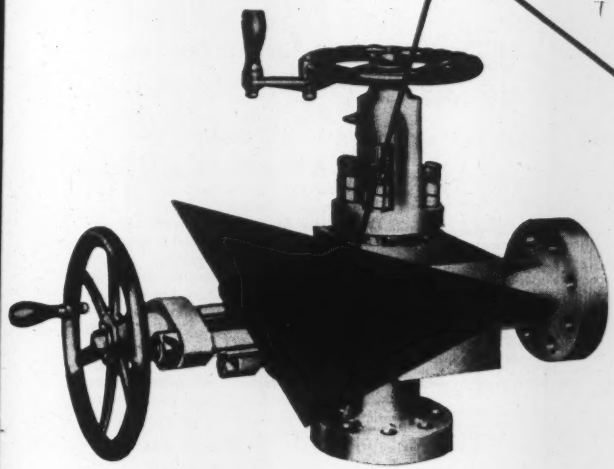
(*ASME News continued on page 278*)

OVER 15,000 BOILER PLANTS USE THESE BLOW-OFF VALVES

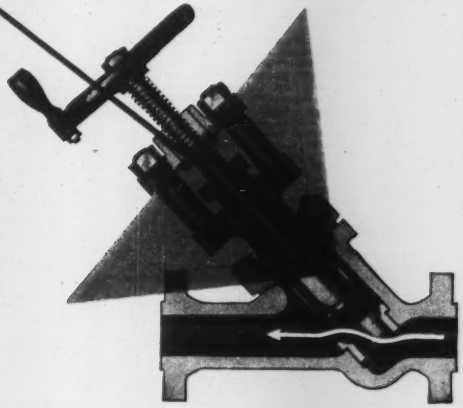
MADE FOR EVERY PRESSURE



This is the famous Yarway *Seatless* Blow-Off Valve. Balanced, sliding, nitralloy plunger design eliminates seat—a common source of wear, clogging and leaking. Type B (above) for pressures 50 to 400 psi, angle or straightway, single or tandem. Other types available for higher pressures. Complete description and specifications in Bulletin B-424 for pressures to 400 psi, or Bulletin B-433 for higher pressures.



The Unit Tandem—Yarway's finest blow-off valve for high pressure service. Combines a Hard Seat Valve (for blowing) and a Seatless Valve (for sealing) in a one-piece forged-steel body, flanged or socket welding ends. Also available combining two hard-seat valves. For pressures to 2500 psi. See Bulletin B-433.



This is Yarway's Stellite-Seat Valve for pressures to 2500 psi. Shown here in open position. Disc and seat ring are stellite-faced and carefully mated for tight seating, long life and hard wear. Angle or straightway, single or tandem combinations (hard seat—hard seat or hard seat—seatless) available. Complete specifications and description in Yarway Bulletin B-433.

YARNALL-WARING COMPANY • 108 Mermaid Avenue, Philadelphia 18, Pa.

BRANCH OFFICES IN PRINCIPAL CITIES

STEAM PLANT EQUIPMENT

experience or an MS degree required. Upstate New York. Y4721.

ENGINEERS. (*a*) Design engineers, 30–45, mechanical degree, five years' experience in heavy industrial equipment, preferably marine equipment. Will be responsible for developing detailed specifications and product applications from general customer specifications. $7500. (*b*) Draftsmen, 30–45, two years engineering college or technical school required, plus five years' experience in heavy industrial equipment, preferably marine equipment. Will prepare working plans and detail drawings from layouts, rough sketches, and notes under supervision of design engineers. About $6000. Y4815.

INDUSTRIAL ENGINEER, mechanical, minimum of five to 10 years' experience in the supervision of machine shop, particularly as applied to aircraft or component parts, to appraise the facilities and personnel working skills, as to ability to accept war contracts. $8000–$10,000. New York, N. Y. Y4836.

MECHANICAL ENGINEER, graduate, for research and development work. Should have had 10 or more years' experience in designing and development of heavy machinery, rolling mills, and hydraulic presses. $6000–$8000. Western Pa. Y4865.

DESIGNER, at least five years' experience in injection-molding field, to design tools and equipment for plastic manufacturer. $7800. Wis. Y4869.

PRODUCTION SUPERINTENDENT, 30–38, mechanical or electrical graduate, to take complete charge of the production department, including control, processing, and planning for manufacturer of vacuum tubes, cathode and television tubes. $6000–$10,000. Northern N. J. Y4877.

PLANT ENGINEER, 35–45, mechanical graduate, at least 10 years' industrial-maintenance experience, to take charge of mechanical and electrical equipment, steam-process facilities, etc., in rubber-products plant. $6600–$8400. Mass. Y4903.

ENGINEERS. (*a*) Mechanical engineer, technical writer on materials for instruments designed for fire control. $4600–$5200. (*b*) Designer-Ordnance, to perform engineering analysis and to check the production design of fire-control equipment and maintenance tools and fixtures for mass production. $4600–$5300. (*c*) Industrial engineer, mechanical, to assist in investigating new methods and procedures employed in nonferrous foundries, electroplating, and general shop practices. $4600–$5300. Philadelphia, Pa. Y4904.

DESIGN ENGINEERS responsible for planning, organizing, and directing engineering projects of broad scope for the purpose of developing new fire-control systems and components thereof. $6400–$7400. Philadelphia, Pa. Y4906.

SUPERINTENDENT OF MACHINE SHOP, up to 55, supervisory experience in machine-shop work in automotive-parts field. Company produces grey iron, malleable, and steel castings, and brake drums for truck and bus. Machine shop equipped with Bullard vertical turrets, Bullard multimatics, and similar equipment, and employs one hundred people. $10,000–$15,000. Midwest. Y4911.

CHIEF ENGINEER, under 45, mechanical degree, experience in the steel and brass industry at the executive-engineering level. Responsible for design and development of new types of machinery for eastern manufacturer of steel tubing sold to ball-bearing companies. $20,000. Y4913.

MANAGER OF PRODUCTION FACILITIES to direct the layout, selection, recruiting, and training program for new plant producing guided missiles. Work involves precision fabricating and assembling. Must have works-manager experience in similar operation. Up to $18,000. Southwest. Y4915.

MECHANICAL ENGINEER, experience in product design for miniature instruments, servomechanisms, miniature hydraulic-control systems, gyroscopes, etc. $10,000–$12,000. Southwest. Y4916.

ENGINEERS. (*a*) Mechanical engineers, 25–50, graduates, about eight years' mechanical and electrical drafting experience of which at least four years must have been in capacity similar to that of a senior draftsman on precision-instrument equipment. $4160–$4940. (*b*) Design engineers, mechanical, 30–50, graduate, working knowledge of machine shop, and about 10 years' mechanical-drafting experience, of which at least four years must have been on advanced design work on precision equipment. Some electrical experience desirable. $5200–$6240. New York, N. Y. Y4928.

MECHANICAL ENGINEERS for research and development work in the textile industry. Under 40, graduates, five to 10 years' experience in machine design and mechanisms, to handle mechanical-research and development work on machines and processes in a textile mill as part of the research division of a large mill group. Previous textile experience not required. $5000–$7000. S. C. Y4934.

INDUSTRIAL ENGINEER to organize an industrial-engineering department. Must be graduate of recognized school of engineering, at least 10 or more years' experience in industrial engineering, some experience in textile and chemical industry, for chemical-processing plant. $8000–$15,000. East. Y4955.

ENGINEERS. (*a*) Senior mechanical engineer for survey, design, and construction of heating, ventilating, air-conditioning, power, and refrigeration installations. $6400. (*b*) Mechanical engineer at least three years' experience for preparation of design, specifications, estimates, and construction of heating installations. $5400. S. C. Y4962.

CHIEF DEVELOPMENT ENGINEER, at least 10 years' experience covering design and development of centrifugal blowers, turbines, or allied equipment, to be responsible for design, development, and engineering of heavy-duty high-speed blower equipment for test tunnel. $10,000–$11,000. Midwest. Y4966.

PLANT SUPERINTENDENT, 35–45, mechanical or electrical, five to 10 years manufacturing and presswork operations for stampings and extrusions. Should be practical mechanic. Knowledge of tools and dies for stampings and extrusions. Will supervise production and tool and die department for plant of about 140 people. About $7500. Ill. R7361.

CHIEF ENGINEER, graduate, 35–45, top-level administrative experience, organization ability, engineering capabilities, and well informed on shop operation of precision mechanisms for engine accessories and controls. Will organize and direct total engineering activity and provide top liaison and correlation of engineering with other manufacturing activities. About $15,000. Ill. R7406.

ASSISTANT MANAGER OF MANUFACTURING, graduate, 35–45, broad and demonstrated experience in administering manufacture of precision mechanisms for engines and controls; completely informed about controls of manufacturing. Will assist in organization and direction of total manufacturing in a defense program. About $15,000. Ill. R7407.

CHIEF TOOL ENGINEER, graduate, preferred, about 35, with extensive experience with tooling up, specification, and purchase of machines, establishing specifications and machining processes for general machine-shop operations. Will direct retooling and new machinery revisions and extensions for original equipment automotive-parts manufacture. $12,000–$14,000. Vienna. R7408.

ASSISTANT PLANT MANAGER, 35–45, completely informed on high-production techniques, general machine-shop operations and machining. Will supervise production, maintenance, and shop scheduling. $15,000–$18,000. Ind. R7409.

SUPERINTENDENT AND GENERAL MANAGER, technical education, extensive experience in heavy-clay-products manufacture, knowledge of ceramics and refractories, informed about production, processes, and machinery used in clay-products manufacturing. Willing to live and represent company in small community. $8400–$9600. Calif. R7412.

Whom Do You Want for President in 1952?

THE National Nominating Committee is accepting proposals for nominations of members for the 1952 Presidency and other offices of the Society.

You as a member can help the Committee to find men of the caliber the Society needs to fill this and other high offices.

For instruction on how to submit proposals to the Committee see page 87 of the January issue.

Please send all proposals to Paul T. Onderdonk, Secretary, ASME National Nominating Committee, Consolidated Edision Company of New York, Inc , 4 Irving Place, New York 3, N. Y.

1951 Society Records Sent Upon Request

MEMBERS of The American Society of Mechanical Engineers who wish to receive copies of Personnel of Council, Boards, and Committees, Annual AC-10, should address their requests to the Secretary, ASME, 29 West 39th Street, New York 18, N. Y.

The Society Records list officers and the Council, personnel of boards and committees, professional divisions, sections, student branches, committees on research, standardization, safety, boiler code, and power test codes. There is a picture and short biography of J. Calvin Brown, president, ASME. Awards and lectureships, with latest recipients and lecturers, are listed followed by honorary members, living present and former officers, deceased past-presidents, treasurers, and secretaries, and an index of the record completes the contents of material.

Candidates for Membership and Transfer in the ASME

THE application of each of the candidates listed below is to be voted on after March 24, 1951, provided no objection thereto is made before that date, and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the secretary of The American Society of Mechanical Engineers immediately.

KEY TO ABBREVIATIONS

R = Re-election; Rt = Reinstatement; Rt & T = Reinstatement and Transfer to Member.

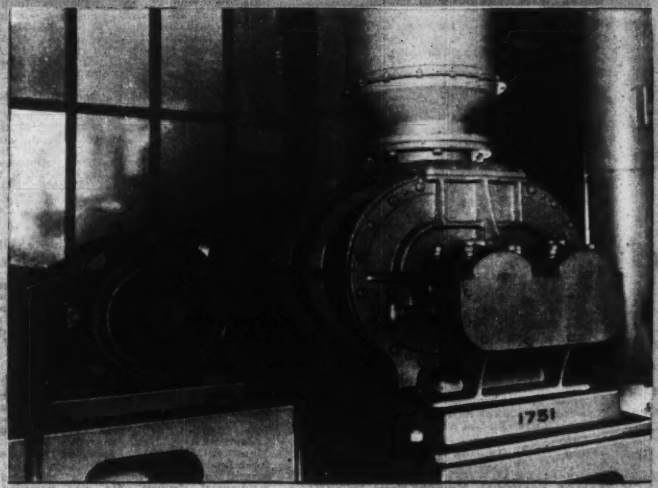
NEW APPLICATIONS

For Member, Associate, or Junior

ADAMS, JAMES Q., Cincinnati, Ohio
ALLEN, M. H., JR., Corpus Christi, Texas (Rt&T)
ANGELL, DONALD S., Opportunity, Wash.
ARMSTRONG, L. V., New York, N. Y.
AYLING, THOMAS H., JR., Roselle, N. J.
AYRES, WALDEMAR A., Lakewood, Ohio
BASSHAM, JAMES H., Verda, Ky.
BECKER, EDWARD L., Los Angeles, Calif.
BLACKBURN, DOUGLAS B., Sparta, N. J.
BROSSEAU, PIERRE, Boston, Mass.
BURGESS, FRANK H., Providence, R. I.
CAMPBELL, RICHARD D., Mansfield, Ohio
CANAVAN, DAVID P., New York, N. Y.
CANNIZZARO, FRANK J., Cliffside Park, N. J.
CLIMER, CARL V., JR., Dayton, Ohio
CLINE, J. GRANT, Altadena, Calif. (Rt)
CONSTANT, C. C., JR., Tulsa, Okla.
COURT, KENNETH, Detroit, Mich.
CROWLEY, JOHN V., Los Angeles, Calif.
DELANEY, HOWARD D., Florham Park, N. J.
DE PIETRO, ALFONSO, New Rochelle, N. Y.
DINI, ARTHUR E., Pekin, Ill.
DOYLE, J. S., Rondebosch, Cape Town, U. of S. Afr.
EVANS, JOHN T., Lansdowne, Pa.
FITZPATRICK, JOHN R., Tulsa, Okla.
FOSTER, G. M., Montreal, Que., Can.
GARLINGTON, R. E., JR., Odessa, Texas
GARRELL, BURTON S., Detroit, Mich.
GERSTACKER, W. G., Cleveland, Ohio
GLOVER, W. WAYNE, Springfield, Pa.
GOLDIE, WILLIAM L., San Gabriel, Calif.
GOLINSKI, J. A., Toronto, Ont., Can.

(*ASME News continued on page 280*)

NO V-P-L WORRIES WITH R-C BLOWERS



ROTARY

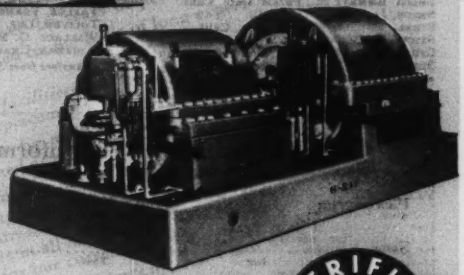
Rotary Positive Blower for pneumatic conveying in large eastern processing plant. Many other R-C units are used in various plants of this same company.

Today's production urgencies call for "no-vacation" performance from blowers and other equipment to move gas and air. You must be sure of positive Volume, at the required Pressure, and at Low power cost to keep down rising expenses. The answer is Roots-Connersville Blowers with V-P-L.

You obtain this freedom from worry whether you install R-C Centrifugal or Rotary Positive equipment. This exclusive *dual-ability* gives you the choice of either type to best meet your requirements. Wide latitude in sizes, from 5 cfm to 100,000 cfm, permits selection of units with capacities close to your specific needs. Often, this flexibility saves time, cost, space, weight and power charges.

R-C engineers will gladly counsel with you on any problem of moving or measuring gas or air to keep production going.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Michigan Avenue, Connersville, Indiana



Two, 4-Stage, Type H Centrifugal Compressors, mounted on common base. Motor driven, with capacities of 11,230 cfm and 8,990 cfm, respectively.

CENTRIFUGAL

ROOTS-CONNERSVILLE

BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES

GRAJEK, HENRY A., Buffalo, N. Y.
GRONAN, JOHN, Staten Island, N. Y.
GUDOR, MICHAEL ALLEN, Pullman, Wash.
GURUNG, P. SINGH, Bihar, India
HAFER, ALVIA ALLISTON, Annapolis, Md.
HAUGHTON, C. B., JR., Swampscott, Mass.
HAWTHORNE, J. W., Wilmington, N. C. (Rt&T)
HENRIKSON, OSCAR W., Chicago, Ill.
HERENDA, ANTHONY G., Hoboken, N. J.
HERMAN, HERBERT H., Chicago, Ill.
HOLBERSON, HENRY A., Youngstown, Ohio
HOLTHOUSE, H. B., Chicago, Ill.
HOWARD, MARTIN, Jackson Heights, N. Y.
HOYT, HARLAN K., Chicago, Ill.
HUTCHINS, JOSEPH L., LaGrange, Ill.
JEFFERY, J. STANLEY, Jackson, Mich.
JORDAN, A. L., Cincinnati, Ohio
KEHOE, EDWARD J., Roslyn Heights, N. Y.
KNACKSTEDT, H., Lynbrook, N. Y.
KONICKI, CHARLES, Detroit, Mich.
KOTTERMAN, CLETUS A., Warsaw, Ind.
KRAMER, HARRY A., Richland, Wash.
KRANZFELDER, E., Alliance, Ohio
LAHMAN, CHARLES J., Dayton, Ohio
LE MAY, JOHN Y., Paterson, N. J.
LESTER, WILLIAM M., Union, N. J. (Rt&T)
LIPPITT, EDWARD G., JR., Charleston, W. Va.
LORENZ, RICHARD L., Chicago, Ill.
LUMLEY, THOMAS H., West Haven, Conn.
MARTT, JUDSON W., Toronto, Ohio
MCGRADY, CHARLES T., Westfield, N. J. (Rt)
MCLEAN, PATRICK, Islington, London, England
MCMULLEN, JAMES F., Bronx, N. Y.
MEALS, WILLIAM D., St. Louis, Mo.
METHENY, JAMES T., Charleston, W. Va.
MUDDIMAN, EARLL R., Pittsburgh, Pa.
MULL, KINGSLEY, Toledo, Ohio
MUSTAFA, MARVIN, East Chicago, Ind.
NEGLEY, CHARLES F., Lafayette, La.
OLSON, NORMAN C., Clifton, N. J.
POOLEY, HARRY JAMES, Toledo, Ohio
POWELSON, ROY E., Thornwood, N. Y.
REECH, GEORGE K., Swampscott, Mass.
REED, MALCOLM E., Dorchester, Mass.
RIDBOUT, THEODORE R., Port Chester, N. Y.
ROMIG, G. V., Baltimore, Md.
ROSE, PHILLIP E., East Chicago, Ind.
ST. CLAIR, C. R., West Lafayette, Ind.
SATTELMEYER, WILLIAM F., Cleveland, Ohio
SCAMMON, RAYMOND B., West Hartford, Conn.
SCHAFFER, LEONARD, Newark, N. J.
SCHRANK, EDWIN P., Akron, Ohio
SEELIG, RICHARD P., Hartsdale, N. Y.
SHIMA, HIDEO, Marunouchi, Tokyo, Japan
SKIDMORE, JOHN G., New York, N. Y.
SMITH, D. I., Holtwood, Pa.
SMITH, EMMETT M., Parker Dam, Calif.
SMITH, JAMES O., Urbana, Ill.
STEEL, DONALD W., Pasadena, Calif.
STICKNEY, CHARLES K., Waterbury, Conn.
STOCKBRIDGE, BRUCE W., Oak Ridge, Tenn.
SUNDAY, ROY EDWARD, Toledo, Ohio
TEARE, ROBERT L., Columbus, Ohio
TOBIAS, HERBERT, New Brunswick, N. J.
TRIMMER, ALBERT S., Flemington, N. J.
TROCHET, FRANCOIS J., New York, N. Y.
URWIN, A. H., Ralston, Alta., Can.
VALLE, ERALDO, Bristol, Va.
WAIBEL, FRED E., Syracuse, N. Y.
WAXMAN, AARON, Bellflower, Calif.
WELLING, EDWARD G., Chicago, Ill.
WHITE, GARLAND B., JR., Kansas City, Mo.
WIESEHAHN, HARRY F., Indianapolis, Ind.
WISSINGER, CHARLES R., JR., Valley Stream, N. Y.
WILLETT, JAMES V., Chicago, Ill.
WILLIS, C. A., Tampico, Tamps., Mexico
WILSON, EARL R., Kent, Ohio
WISE, ROBERT LOUIS, New York, N. Y.
WOLFE, W. A., Vancouver, B. C., Can.
WOOD, J. M., JR., Wyndmoor, Pa.
WRIGHT, CLIFFORD C., Berkeley, Calif.

CHANGE IN GRADING

Transfers to Member and Associate

ADAMSON, ARTHUR P., Ballston Spa, N. Y.
BORST, ROBERT O., San Diego, Calif.
CHAMBELLAN, RENE E., Fort Lee, N. J.
CHASMAN, BERNARD, Dayton, Ohio
CHRISTENSEN, BOYD, Ponca City, Okla.
COPITHORNE, A. RUSSELL, Chelsea, Mass.
CRUM B, A.B., JR., Mercer Island, Wash.
CUSHING, HENRY J., New York, N. Y.
DUGGAN, HERBERT G., Oak Ridge, Tenn.
FRISCH, G. M., South Charleston, W. Va.
HABICHT, FRED H., La Grange, Ill.
HARTMAN, JOHN HENRY, Williamsport, Pa.
HENDERSON, E. F., Spokane, Wash.
HOCHNER, ROYAL M., Akron, Ohio
HULL, T. N., JR., Schenectady, N. Y.
JUDD, S. F., Chattanooga, Tenn.
KOPETZ, WALTER H., Pittsburgh, Pa.
KOSTIR, EDWARD, Cleveland, Ohio
LEMPERA, EDWARD J., Berwyn, Ill.
LESCH, RAYMOND T., Minneapolis, Minn.
LUCKY, MURRY E., Gulfport, Miss.
MADEA, FREDERICK J., Westfield, N. J.
MAHONEY, WILLIAM R., Hammond, Ind.
MEIER, WILLIAM G., Mason, Mich.
MEYER, ARNOLD I., Los Angeles, Calif.
MOZISEK, A. R., Dallas, Texas
NEWTON, JOHANNES S., Rivera, Calif.
OSTER, CLETUS J., Los Angeles, Calif.
PENNINGTON, JOHN W., Baltimore, Md.
SAMUEL, H. D., JR., Los Angeles, Calif.
SEAY, J. D., JR., Kingsport, Tenn.
STONEBURNER, C. W., Texas City, Texas
TAYLOR, VERNON C., Newport News, Va.
TOLIVER, LEE, Albuquerque, N. Mex.
WALLACE, G. M., Denver, Colo.
WEISMAN, CHAUNCEY, Los Angeles, Calif.

Transfers from Student Member to Junior 100

ASME Master-File Information

(*Not for use of student members*)

Please print — **Check mailing address**

Name ..... (Last, First, Middle)

Home address ..... ☐ (Street, City, Zone, State)

Name of employer .....

Address of employer ..... ☐ (Street, City, Zone, State)

Product or service of company .....

Title of position held .....

Nature of work done .....

I am a subscriber of (please check)

Transactions ☐ Journal of Applied Mechanics ☐ Applied Mechanics Reviews ☐

(*Processing of address change requires four weeks*)

Obituaries

Baxter Hunter Bruce (1887–1950)

BAXTER H. BRUCE, whose death was recently reported to the Society, was smoke-regulation engineer of the City of Akron, Ohio. Born, Stanton, Mich., June 1, 1887. Education, BS, U. S. Naval Academy, 1907. Mem. ASME, 1949.

Mansfield Estabrook (1877–1950)

MANSFIELD ESTABROOK, who was at one time president, Maag Gear Corp., a subsidiary of the Niles-Bement-Pond Corp., machine-tool manufacturers, died Dec. 29, 1950. Born, Philadelphia, Pa., June 28, 1877. Parents, John Davis and Eliza O. (Manafield) Estabrook. Education, BA, Harvard University, 1899; BSME, Massachusetts Institute of Technology, 1901. Married Helen Slocum Nichols (died 1928). Jun. ASME, 1903; Mem. ASME, 1919. Survived by two sons, James M. and John N., and a daughter, Laura.

Cortland Mueller Hatfield (1903–1950)

CORTLAND M. HATFIELD, chief engineer, Metal Hose Division, American Brass Co., Watertown, Conn., died Dec. 10, 1950. Born, Cortland, N. Y., Sept. 11, 1906. Parents, Charles Belmont and Maude (Mueller) Hatfield. Education, attended University of Florida, 1926–1929; Cornell University. Married Helen Worster, 1935. He held several U. S. patents. Mem. ASME, 1946. Survived by wife and three children, Cortland M., Jr., Kathryn W., and Stephen C.

Rudy Ehrhard Herklotz (1887–1950)

RUDY E. HERKLOTZ, master mechanic, Ford Motor Co., Naval Barracks, Dearborn, Mich., died Dec. 13, 1950. Born, Hetzdorf, Germany, April 14, 1887. Parents, Ernst and Lina Herklotz. Education, diploma, Polytechnic Institute of Leipzig, 1912. Naturalized U. S. citizen, Detroit, Mich., Jan. 12, 1926. Married Margaret Gay, 1931. Mem. ASME, 1947. Survived by wife.

Ernest John Sweetland (1880–1950)

ERNEST J. SWEETLAND, consulting engineer, firm of Ernest J. Sweetland, San Francisco, Calif., died Nov. 15, 1950. Born, Carson City, Nev., May 26, 1880. Education, public schools, Carson City, Nev. Married Nellie Riley. Mem. ASME, 1917. Invented and patented Sweetland Filter Press, 1916; purolator, 1925; several inventions for hospital use, and other mechanical devices. He was awarded John Scott Medal by The Franklin Institute, 1918; certificate by National Association of Manufacturers, 1950. Survived by wife, three sons, Ernest J., Jr., Pasadena, Calif.; William E., Eugene, Ore.; Eugene D., Oakland, Calif.; and three daughters, Mrs. Kathryn S. Beckett, Orinda, Calif.; Mrs. Ruth S. Posey, Altadena, Calif.; Mrs. Helen S. Newman, Denver, Colo.

Clifford William Wood (1918–1950)

CLIFFORD W. WOOD, mechanical engineer, Edge Moor (Del.) Iron Works, died in Fort Dodge, Iowa, Oct. 28, 1950. Born, Springfield, Mass., July 16, 1918. Parents, William Albert and Mabel Belle Wood. Education, BSME, Virginia Polytechnic Institute, 1947. Jun. ASME, 1947. Survived by parents.

Keep Your ASME Records Up to Date

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The uniform dependability that has distinguished Clevelands through 38 years has established "Cleveland quality" as the measure of value in worms and gears. Cleveland sets the pattern through four outstanding features:

1. *Correctness of design*—proved by years of performance.
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JENKINS PRACTICAL PIPING LAYOUTS 54

How to plan

STEAM DESUPERHEATER PIPING CONNECTIONS

In plants where steam is required at lower than boiler pressure, it is usually obtained by means of pressure reducing valves. This low pressure steam is highly superheated and the superheat must be removed before it can be used in low pressure equipment.

The system shown employs pressure reducing valves and a desuperheater. These valves in turn operate water regulator valves which allow water at high pressure from the boiler feed pumps to flow to the desuperheater nozzle. An automatic regulator controls the amount of water flow based on the downstream temperature.

For the distribution of high pressure steam, Jenkins Fig. 1012 Cast Steel, Outside Screw and Yoke Gate Valves are recommended. Ruggedly designed to withstand pressure strains and rapidly vibrating steam currents, these valves, when fully open, permit an unobstructed flow. Screwed-in seats are replaceable and valves can be packed under pressure.

Consultation with accredited piping engineers and contractors is recommended when planning any piping installation.

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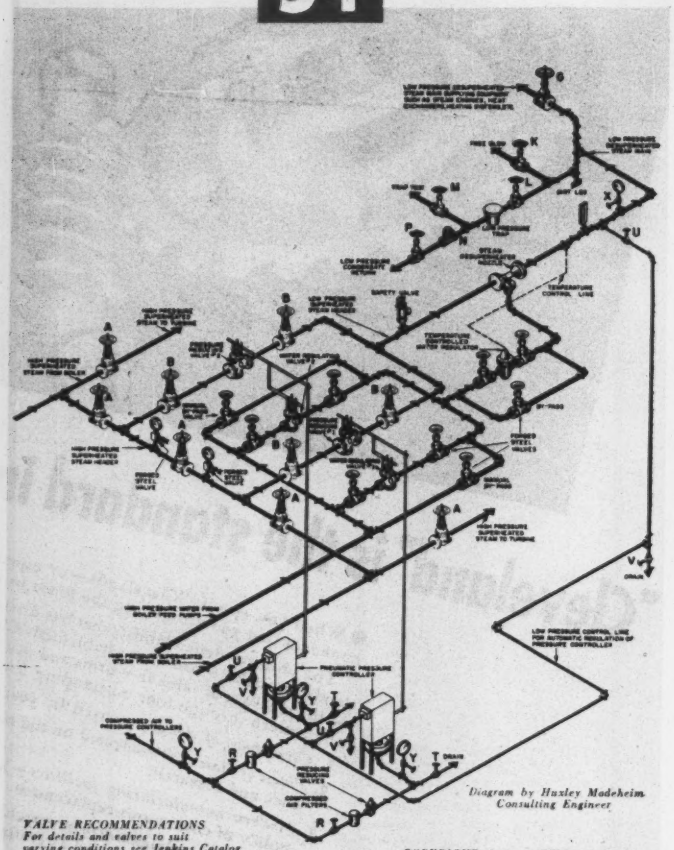

Diagram by Huxley Madeheim, Consulting Engineer

VALVE RECOMMENDATIONS
For details and valves to suit varying conditions see Jenkins Catalog

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Code	Quan.	Jenkins Valves	Service
A	5	Fig. 1012 Cast Steel Gate	High Pressure Superheated Steam Distribution
B	4	Fig. 1012 Cast Steel Gate	Pressure Reducing Valve Shutoff
G	1	Fig. 1009 Cast Steel Gate	Low Pressure Desuperheated Steam Shutoff
K	1	Fig. 106-A Bronze Globe	Condensate Free Blow
L	1	Fig. 670 Bronze Gate	Condensate to Trap Shutoff
M	1	Fig. 106-A Bronze Globe	Trap Test
N	1	Fig. 92 Bronze Check	Prevent Condensate Backflow
P	1	Fig. 670 Bronze Gate	Condensate Shutoff
R	2	Fig. 106-A Bronze Globe	Compressed Air Supply to Pneumatic Controllers
T	2	Fig. 106-A Bronze Globe	Compressed Air Line Drains
U	3	Fig. 106-A Bronze Globe	Pressure Control Line Drains
X	1	Fig. 741-G Bronze Needle	Pressure Gauge Control
Y	3	Fig. 741-G Bronze Needle	Compressed Air Pressure Gauge Control

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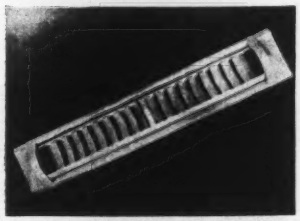
• NEW EQUIPMENT

York Rotary Air Conditioning Grille



Pittsfield, Mass.—A plastics grille designed to direct air into practically every part of a room is being molded by General Electric's Chemical Department for the York Corporation's threequarter horsepower model, window-type air conditioner. The grille is two feet long and is injection molded from polystyrene.

Being rotary in design, air can be directed either up or down through eighteen small louvres, which are mounted on a single frame. Each louvre can be adjusted to direct air to the left or right.

The grille is being supplied to the York Corporation completely assembled, including hardware, for speedy installation. When received, the unit has only to be placed in position and fastened with screws.

New "Insurok" Laminate Features Uniform Strength in All Directions

A new phenolic laminate reinforced with unwoven cotton fibres, random laid in the form of a mat, has been announced by The Richardson Company, Melrose Park, Illinois, makers of Insurok laminated and molded plastic products. This laminate features uniformity of strength in all directions, outstanding machinability, and improved texture.

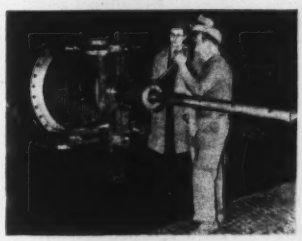
The new laminate, designated Insurok Grade T-815, is primarily intended for mechanical applications requiring uniform strength throughout, such as nonmetallic gears, cams, pinions, textile bobbin heads, and many other industrial parts. Grade T-815 is reinforced by unwoven cotton fibres, random laid in a mat arrangement. This structure results in a uniformity of strength (tensile, impact, and flexural) in the main direction, cross direction, and at all intermediate angles throughout the plane of the material. The physical characteristics of Grade T-815 are rated as better than high-strength, woven cotton fabric-base materials.

Machinability of Grade T-815 is excellent, and machined surfaces have a finish superior to any woven cotton fabric-base laminate made. It can be punched, shaped, turned, milled, drilled, or threaded, and such operations result in very smooth, clean surfaces—similar to the machined surfaces of dense paper-base laminates. Intricate machined shapes, such as fine-pitch gears and threads, are easily obtainable. The new laminate also has good electrical and moisture resistant properties—improved over ordinary cotton fabric-base materials.

Insurok, Grade T-815, is available in a complete range of sheet sizes and thicknesses. Descriptive data sheet is available upon request. Write The Richardson Company, 2763 Lake St., Melrose Park, Ill.

Designs New Method for Removing Heat Exchanger Bundles

The development of a new method of removing exchanger bundles, which results in lower initial investment for supporting structures in processing plants, was announced by The M. W. Kellogg Co., refinery and chemical engineers of Jersey City, N. J.

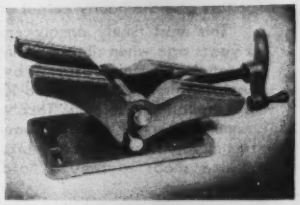


According to Kellogg, bundles in shell and tube heat exchangers may now be removed by the special Exchanger Jack pictured above. It has been designed by this engineering firm to save construction costs, for exchangers supported above the ground, by eliminating conventional pulling beams and their related structures.

Other economic advantages, cited by Kellogg, include the fact that this improved bundle remover may permit a more compact general plant layout and thus a smaller plot. Furthermore, exchanger supports themselves may be made somewhat lighter since they need not be designed to resist the stress of conventional bundle removing arrangements.

The tube bundle removing device is portable and consists of a modified commercial center-hole hydraulic puller. It has an extensible, jointed ram and an adjustable yoke to transmit force against the bonnet end shell flanges of exchangers of various sizes. The device can exert a push on the tube bundle up to 12,000 pounds for a maximum distance of 16 feet, permitting the removal of dirty bundles that could not be pulled by usual means. After cleaning, bundles are replaced by the same equipment.

New Tilting Motor Use for Fractional H. P. Motors



A new, light weight Tilting Motor Base, adjustable in width and length to accommodate all sizes and types of fractional motors up to one hp., is announced by the Lovejoy Flexible Coupling Co., Chicago. Used with variable speed drives and for easy belt changing on Cone Step Pulleys, the unit acts as a belt tightener as well. A handle screw adjustment provides exact speed control and changes while the machine is in use. Correct belt tension and alignment is constantly maintained, according to the manufacturer.

Claimed to be the world's lowest priced adjustable motor base, at $6.00, the new Lovejoy Tilting Base (Pat. Pending) is $5\frac{1}{2}'' \times 7''$ in size with a shipping weight of 10 lbs. Literature available from the Lovejoy Flexible Coupling Co.

New Floating Cranes for Navy

Pittsburgh, Pa.—Authorization has just been received here by Dravo Corp. for the furnishing of 13 floating cranes for the Department of the Navy, Bureau of Yards and Docks. Seven of the cranes will be of 100-ton capacity and six will be rated for 60-ton loads. Two of the larger units are for West Coast delivery; the others for assignment to Atlantic ports.

Both types of cranes will be patterned after similar equipment developed by Dravo for the U. S. Army Transportation Corps during World War II. A number of these cranes were built for both the Army and the Navy while additional units were constructed by other companies to the Dravo design.

Capable of lifting loads as large as fully-assembled railroad locomotives, some of the 100-tonners performed vital materia handling jobs for American invasion forces in both the European and Pacific Theaters.

Perhaps the most famous of the cranes was the one towed across the Atlantic Ocean to newly-captured Cherbourg. Within 24 hours after arrival, the unit was in service to help break an unloading bottleneck created by the almost complete demolition of permanent wharf facilities. For this outstanding job, the crane was "cited for meritorious performance" by the Army.

The new contract covers complete fabrication and assembly of both hulls and cranes

Continued on Page 42

Now Available

NEW CLASS H* MOTORS PROTECTED BY DOW CORNING SILICONES

. . . the insulation that has already saved industry millions of maintenance dollars plus the hourly output of hundreds of thousands of men!

This most timely announcement caps the test program we started 8 years ago when silicone resins were introduced by Dow Corning Corporation. First we proved by accelerated life testing that silicone insulated motors had a good 10 to 1 advantage in life expectancy and wet insulation resistance. Then we sold silicone (Class H) insulation to the manufacturers of electrical equipment ranging from lift truck and traction motors to solenoid and brake coils. We also encouraged the better rewind shops to rebuild hard working industrial motors with Class H insulation.

Now we can proudly refer American industry to this goodly list of electrical manufacturers, all able and willing to supply electric machines protected by Class H insulation made with Dow Corning Silicones.

Take your special problems to the application engineer representing any of these companies or to our Product Development Engineers.

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ALLIS-CHALMERS MANUFACTURING COMPANY
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KURZ & ROOT COMPANY
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THE MASTER ELECTRIC COMPANY

* "Class H" insulation is the kind of insulation that keeps motors running in spite of "Hell and High water." (language dictionary)

DOW CORNING CORPORATION
MIDLAND, MICHIGAN
DOW CORNING SILICONES

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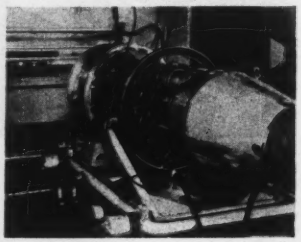
which will be of all-welded construction. Operation will be diesel-electric. Considerable engineering is contemplated by Dravo to bring the designs up to the most modern standards.

Jet Engine Test Cells Silenced By Unique Use Of Insulating Firebrick

The unique application of an insulating firebrick to muffle the roar in jet engine test cells has been made public by The Babcock & Wilcox Co. The firebrick is being used in exhaust stacks at the Lockland, Ohio, plant of the General Electric Company where engines for J-47 turbo jets are manufactured. A total of 14 test cells have been treated with the B&W Insulating Firebrick.

Noise made by exhaust gases from the engines, forced out of the stacks at a velocity of 275 to 340 miles an hour, without sound treatment would be extremely objectionable, it was explained. With the insulating firebrick used acoustically, the sound is so reduced that at a point a short distance from the plant it is no louder than a noisy office.



Developed by the Refractories Division of The Babcock & Wilcox Company, the brick, known as B&W K 26 Insulating Firebrick, is normally employed for high temperature insulation for lining industrial furnaces. Several years ago, tests on this insulating firebrick showed that it had unusual sound absorbing properties as well as resistance to high temperature.

The plant at Lockland had been used for the manufacturing of propeller type airplane engines by the Wright Aeronautical Corporation during World War II and was acquired from the government by General Electric. Cells for testing this type of engine were an integral part of the building, constructed with reinforced concrete walls. Although the space allowance was smaller than is usually required for jet engine testing, the original cells were utilized successfully with the insulating firebrick used as acoustical material. Ordinarily, the larger the area acoustically treated, the more efficient is the sound reduction.

The test cells are chambers approximately 80 feet long and 20 feet wide. From a side view they appear U-shaped, with a 20-foot ceiling rising to 45 feet at each end. Air for combustion of the fuel is admitted through one of these ends, passes through and around the motor placed for testing in the chamber, and is ejected along with exhaust gases from the engine, through a steel pipe which runs part of the length of the cell and makes a right angle bend to go up 20 feet into the exhaust stack.

The exhaust stack is 50 feet high with an inside diameter of six and one half feet. It is lined with the specially treated B&W K 26 Insulating Firebrick four and one half inches thick. This material was chosen for its insulating and acoustical properties combined

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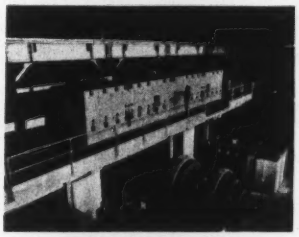
with the ability to withstand heat. Exhaust gases passing through the stack may have a temperature as high as 900° Fahrenheit. Most sound absorption material will not withstand this degree of heat.

The considerable lessening of noise indicated by sound level recordings taken at the stacks and at various distances from the plant, is due in great measure to the reduction of a wide range of sounds which commonly are hard to suppress. The insulating firebrick used in the stacks is unique in that it absorbs sound efficiently over a wide range of frequencies. Many acoustical materials are capable only of selective absorption. That is, they may absorb high frequency noises and have very poor absorption characteristics for low frequency sounds, or the reverse may be true.

After more than two years' service the stack linings of all the cells were reported still in excellent condition.

Largest Metal-Enclosed Drawout Switchgear Ever Built By G.E. Installed By Cleveland Plant of Jones & Laughlin Corp.

The largest metal-enclosed drawout switchgear for heavy-duty d-c service ever built by the General Electric has been put in service in the blooming-mill motor room of Jones & Laughlin Steel Corporation's Otis Works at Cleveland, Ohio.

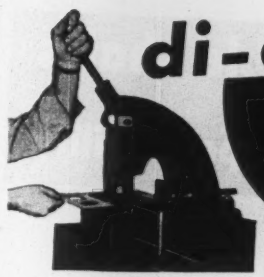


The switchgear consists of 18 breaker and control units which control two 1000-kw 250 volt ignitron rectifiers, a 1500-kw 250 volt motor-generator set and twelve automatic reclosing feeder circuits. In addition to the heavy-duty d-c breakers in the rectifier cathode circuits, the installation includes high-speed metal-enclosed drawout anode circuit breakers for the rectifiers; these are located in separate structures adjacent to the rectifiers.

The G-E Switchgear Divisions, which manufactured the J&L equipment, only recently extended their line of metal-enclosed switchgear to the field of heavy-duty d-c service in steel mills. The new line also meets the needs of other large industrial establishments and large d-c traction substations.

Built for use on 250- and 600-volt d-c systems in ratings up to 8000 amperes, the new line of switchgear equipment utilizes the heavy-duty Type MC-5 magnetic air circuit breaker in a completely metal-enclosed drawout structure. Control and measuring apparatus is mounted on swinging panels integral with the structure.

The breakers are mounted on roll-out carriages, with safety interlocks, which provide easy withdrawal for inspection and maintenance. All breakers of like ampere rating are interchangeable so that spare elements may be substituted to maintain continuous service while regular units undergo maintenance. According to G-E engineers, the entire equipment is built to withstand the extremely high values of short-circuit current encountered in large d-c power systems.



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NEW DOUBLE PURPOSE PRESS

Available in two sizes, 6" and 12" throat depth

Now you can punch holes of various shapes as large as 4" diameter in 16 gauge steel—also blank, draw, emboss, form—all with the new DI-ACRO Punch. It is ideal for both experimental and production work.

The precision ground triangular ram of this double purpose press prevents punch head from turning, assuring perfect alignment at all times for accuracy in duplicated parts.

A Turret Stripper of exclusive DI-ACRO design automatically strips material from punches of all shapes. Roller Bearing cam action develops 4-ton pressure with minimum effort. Adjustable gauges assure exact location of holes.

Send for "DIE-LESS DUPLICATING" *Catalog*

Gives the full story of the DI-ACRO Punch, and also DI-ACRO Benders, Brakes, Shears, Rod Parters, Notchers, as well as the new DI-ACRO Vari-O-Speed Powershear and Hydra-Power Bender.

DI-ACRO is pronounced "DIE-ACK-RO"

DI-ACRO PRECISION MACHINES DIE-LESS DUPLICATING

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Develop Cellular Rubber of Hycar Pa-21

Substantially lower in price, but with much of the high temperature efficiency of cellular silicone rubber is a newly developed cellular rubber compounded of Hycar Pa-21 synthetic rubber by The Sponge Rubber Products Co. of Shelton, Conn. The company indicates its use to be desirable in commercial and defense applications such as grommets, pads, gaskets and shock mounts requiring resistance to ozone, oil and gasoline, and excellent compression set properties. In performing at intermittent temperatures of 400° F. and for a week continuous at 300°–350° F., the new stock contrasts with standard crude stocks which melt after a few hours at 300° F. and the company's best crude high temperature stock which deteriorates after three days at 300° F.

Open or closed cell structure is available, the open cell material having poor resistance to water, in that it swells, while the closed cell material is practically impervious to water and has a K factor of 0.28–0.30. Developed to function at high temperatures, the new cellular rubber stock is not efficient at temperatures below freezing, other stocks of crude which perform at —94° F. being available for such temperatures.

Step Regulators Take to the Air

Station-type transformers and regulators employed to regulate voltage have in general been devices in heavy tanks requiring installation on the ground. These devices have recently been supplemented by designs that bear very little resemblance to the old.

The new devices use cylindrical pressed-steel tanks common to distribution transformers. This change, plus the adoption of wound cores of Hipersil grain-oriented steel, has reduced the weight to the point that they are no longer earth-bound. Even the largest can be pole mounted. Weight reduction is one of the outstanding features of the new step regulator. The previous Westinghouse 50-ampere model weighed approximately an even ton; the new one 1240 pounds.

The new regulator (URL-8) provides a range of voltage control of 10 per cent in eight $1\frac{1}{4}$ per cent steps. The small steps give smoother adjustment of voltage.

Other important operating improvements have been made. The load tap changer position of a unit in service can be read from the ground—saving many a trip up a pole. The ten-per cent range of regulation can be shifted with respect to the nominal line voltage (to accommodate basic changes in circuit load conditions) by operating a switch by hand through a cover hole without tools—and without even having to look inside. With this feature a load-current increase is made available when this switch is adjusted to obtain a downward voltage regulation.

All control elements, instead of being fixed mounted as separate elements on a panel, are grouped within a standard, plug-in (Flexitest) relay housing developed a few years ago for switchboard use. Thus the entire control element can be removed without tools by a lineman and replaced instantly by another. The replaced unit can then be taken to the service shop for maintenance under shop conditions and by men skilled in instrument and relay work. Servicing under the handicap of pole-top conditions is avoided.

Continued on Page 44

S.S.White flexible shafts *pay off in* performance and dependability

"YOU DON'T HAVE TO BABY IT... *it's built for round-the-clock duty*"

says the Dumore Company, Racine, Wis., about the flexible shaft tool shown above. One important reason for the rugged dependability and durability of this tool is the S.S. White flexible shaft which transmits power from the motor to the handpiece.

Where quality and performance are a factor, it pays to consider S.S.White flexible shafts. Their smooth, positive, troublefree operation and long service life are known quantities wherever flexible shafts are used.

WRITE FOR NEW BULLETIN 5008

It contains the latest information and data on flexible shafts and their application. Write for a copy today.

S.S.White MAKES IT RIGHT

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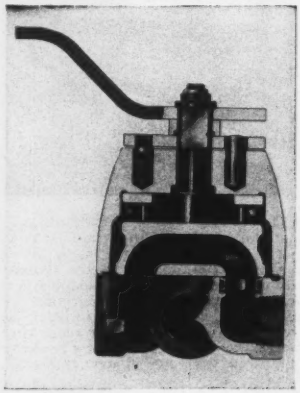
The tap-change switch is maintained in a chamber separate from the transformer, so that all carbon formed by switch operation is prevented from collecting on the transformer windings.

New Extreme Pressure Valve Design

The patented sealing principle employed in Barksdale Valves was specifically developed for extreme pressure control. It is commercially known as the "Shear-Seal" principle, pointing up the fact that to shear off the fluid flow requires the least amount of effort.

A pressure balanced, self-aligning, tubular valve seat keeps perfect intimate contact with the mating surface of an optically flat porting disc. The rotary movement of this disc (or rotor) opens and closes the flow passages. During the absence of fluid pressure a heavy marcel springwasher maintains the contact between sealing surfaces, while a predetermined hydraulic force acts on the seal under extreme pressure. Fluid flow is always through the hole in the center of the "Shear-Seal," never across sealing surfaces. This is an important characteristic particularly in the control of dirty high velocity fluids, because it eliminates the problems of scoring and wire drawing. The wiping and lapping action between the sealing members during each operation actually improves the sealing properties of the valve with use.



Production models of the new valve design illustrated, cover a complete range of the following types and pressures: Shut-off valves from $\frac{1}{4}$" to $1\frac{1}{2}$" for pressures 0 to 6000 psi; 4-way selector valves from $\frac{1}{4}$" to $1\frac{1}{2}$" for pressure 0 to 6000 psi; 4-way dual pressure valves in two classes, (1) for 3000 psi maximum pressure, (2) for 6000 psi maximum pressure; manipulator valves from $\frac{3}{4}$" to 1" for pressures 0 to 1500 psi. The service ratings include all common industrial media such as water, air, hydraulic oil, gas, fuel and petroleum.

The castings of the bodies, housings and rotors represent advancements both in design and metallurgy. Rotors are hardened corrosion resistant steel castings with smooth rounded flow passages that minimize resistance and turbulance. In the 4-way valve, the rotor is constructed to allow for a switch of the same valve from "open center" to "closed center." Bodies are high tensile hydraulic bronze and available with regular in-line porting, straight, or manifold porting.

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Housings are corrosion resistant meehanite and designed for flexibility in mounting. The same valve may be table, bracket or panel mounted.

Manufactured by Barksdale Valves, 1566 East Slauson Avenue, Los Angeles, California.

Blue Asbestos

Flexitallic "blue" is a new product identification for asbestos-filled gaskets made by the Flexitallic Gasket Co., Camden, N. J.

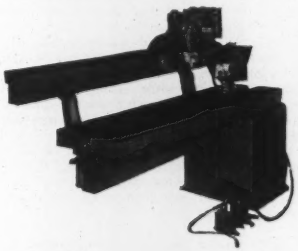
Effective February 1st, blue-dyed asbestos is used between the V-crimped metal plies in metal-asbestos gaskets made by the Company. Approximately 90% of their production is affected. All-metal gaskets and gaskets using other types of filler, such as Teflon, will not carry the color identification.

This is the second step in a product-identification program begun last year with the stamping of the name Flexitallic in the metal spiral of each gasket.

New Welding Process

Automatic hidden arc welding has been limited in application to jobs where the joint to be welded is in position for downhand welding. A new process, developed and patented by The Lincoln Electric Company, Cleveland, removes this limitation and extends the advantages of automatic hidden arc welding to jobs where the joint is in positions other than that for downhand welding.

This new process consists of new welding methods, procedures and equipment wherein the previous difficulties of directing the electrode and retaining flux and molten metal in a joint not lying flat are overcome. With this process the plate being welded may be positioned anywhere from flat to vertical, the joint being horizontal.



The new process, referred to as "3 o'clock" welding, greatly reduces the cost of welding and expands the possibilities for the application of hidden arc techniques. Because joints can be positioned horizontally, welds from both sides of the joint can be made simultaneously. This reduces actual arc time on a given joint by about 50% and results in lower direct labor costs. Positioning each weld for downhand welding is eliminated thus reducing handling and set-up time.

In addition to reducing direct labor costs, savings are made because of the smaller sizes of electrode wire used. For example, where on a downhand application a $^{7}/_{32}$" diameter electrode would be used, in a "3 o'clock" position a $^{5}/_{32}$" or $^{1}/_{8}$" diameter electrode is used. This means: lower currents are used; less electrode is required; smaller quantities of flux are consumed; welds of reduced cross sectional area are made, thus

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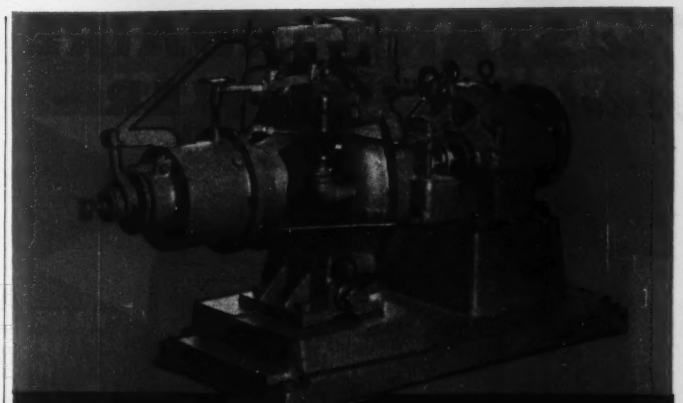
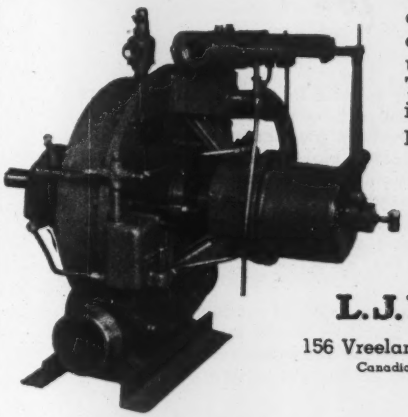


Wing Turbines as an Alternate Source of Auxiliary Drive

The use of turbines as an alternate source of auxiliary drive is good business in these days of urgent production and uncertain industrial conditions. When electric motor drive is subject to power failures due to strikes, fires, floods, hurricanes (or bomb attack), the ability to continue with steam auxiliaries is an advantage that is worth many times the cost of the alternate equipment. And the use of Wing Steam Turbines for such services as pumps, compressors, fans, blowers, generators, etc., can cut power costs by acting as a reducing valve on boiler steam for use in process and heating.



L. J. Wing Mfg. Co.

156 Vreeland Mills Road, Linden, N.J.

Canadian Factory: Montreal, Canada

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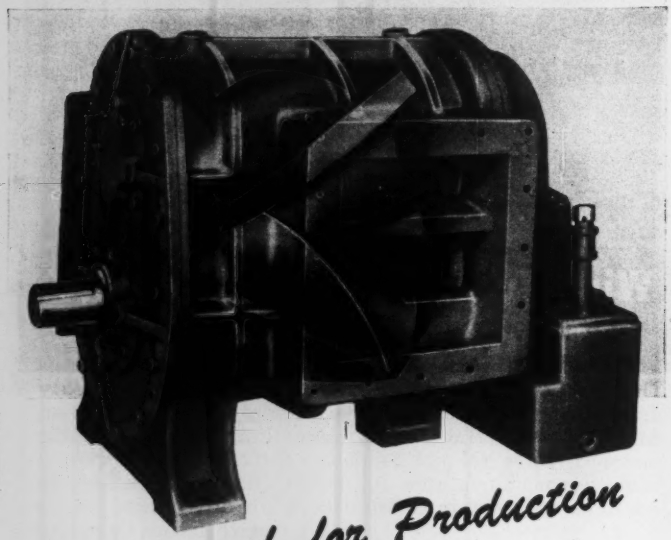
AUXILIARY TURBINES

The STANDARDAIRE Axial Flow BLOWER ~



Engineered for Production

To meet the increasing demand for Standardaire Blowers our manufacturing facilities have progressed from custom built techniques to precision production methods for the principal components of the blower. In addition to other improvements, new manufacturing processes and equipment are now being used to generate the cycloidal form, screw type main and gate rotors on a production basis without sacrificing precision and accuracy of fit—important details in maintaining the "air screw" action feature of the Standardaire Blower.

Through this unique achievement in production engineering it is possible for Standard Stoker to offer industry a Standardaire Blower with the design features and efficiency of a custom built job at the availability of a quantity production unit.

Consult with our engineers on how the modern design Standardaire Blower can be adapted to suit your requirements. Write Dept.E14 The Standard Stoker Co., Inc., 370 Lexington Avenue, New York 17, New York.

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Standard Stoker 556

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wasting less metal in unnecessary build-up. Welds can be made in either straight seams or following an irregular contour. Other advantages of the new process are a minimizing of the effects of distortion and the causes of weld cracking. Tendency for burn through is reduced and back-up strips can be eliminated where two arcs on opposite sides of the work are used.

The process is ideal for applications such as fabricating pipe, box sections, special I-beams and H-sections, joining clips to automobile bumpers, field erection of large outdoor storage tanks, farm machinery parts and other machine frames.

Uses Carboloy Lathe Tools in Milling Cutter

Two-pass milling of a turbine part with a conventional 14-blade cutter has been cut to one pass by use of a simple step fly-cutter at the Fitchburg, Mass., plant of General Electric Company's Turbine Division. On this operation, use of a fly-cutter, which mounts four standard Carboloy lathe tools in an old fly-cutting head, has also cut tool grinding and resetting costs.

Used in a Sellers horizontal mill with 5" spindle driven by a 15 hp motor, the new step cutter removes $1/2$" of material, the tools being set so that the cut is broken up into four $1/8$" steps. No operating difficulty has been experienced in taking the entire cut in one pass, whereas the former cutter frequently stalled while taking the cut in two passes. The fly-cutter also produces a good finish and the tools need sharpening only once every eight hours.

The cutter is 14" diameter. Standard Carboloy 1" shank tools are used. Radial depth of the slots in the fly-cutting head progresses 0.050" per slot so each tool cuts a separate circular track.

Dynamite Storage Containers

Safe storage of dynamite has long been a problem for construction firms and others who handle large quantities of the explosive.

Now, the Hunkin-Conkey Construction Co. believes it has a solution to the problem. On one of its projects, extension of the Pennsylvania Turnpike near Pittsburgh, the company is using about 8,000 pounds of dynamite weekly.

To store large amounts of the explosive near blasting sites and protect it against pilferage, the company uses two big welded steel shipping containers. The 275-cubic-foot boxes with a weight capacity of six tons were developed by Dravo Corporation, Pittsburgh for steamship lines to eliminate pilferage, minimize breakage and ease pier and shipboard handling of export cargo.

Hunkin-Conkey engineers say the containers are ideal for dynamite storage and tool cribs because they can be transported by barge, ship, railroad car or truck. Equipped with skids, they can be dragged by tractors. Lifting rings are provided on the top for mov-

ing them with a crane. The doors are fitted with locks.

To minimize the hazard of sparks from contact of shoe nails or tools with the metal floor and walls, the dynamite containers were lined with one-inch sheathing. This also acts as a barrier to lessen the impact of stray bullets in hunting areas. The boxes are weathertight and can be stored in the open.

By using the steel containers, which are known as Dravo Transportainers, the construction company has been able to purchase dynamite in larger lots and take advantage of quantity buying discounts which run as high as 35 percent.

In addition to the two Transportainers for dynamite, the company has another one for storage of valuable tools.

New Tri-Clad *High-Speed Synchronous Generators Announced

The General Electric Co. has announced that it has extended its line of Tri-Clad high-speed synchronous generators down through 1.875 kva. This now makes available a complete line of generators in Tri-Clad construction from 1.875 to 1250 kva. The new machines which have been added to the line are available in four basic designs, which have ratings from 1.875 to 50 kva.

Designated as Types ATI, ASI, and ATB, the generators have frequency ratings of 60 and 400 cycles. Three standard types of 60 cycle generators are offered, providing a range of characteristics for several different categories of voltage regulation and motor starting requirements. Variations of the basic machines are available with special characteristics for special applications.

The basic 60 cycle design is an externally regulated generator designed to operate with standard voltage regulator in the exciter field circuit. Standard excitation voltage is 64 volts, but equipments suitable for 125 volts excitation are available, G-E engineers explained. Ratings at 60 cycles vary from 2 kw, single phase to 15 kw, 3 phase.

A modification of the basic 60 cycle line provides self regulated features for applications where average voltage regulation and motor starting ability is desired. Voltage regulation of 12 per cent at 0.8 pf with 3 phase loads is obtained by special saturated magnetic circuit design, together with overhung exciter for stiff excitation source. According to the engineers, ratings are available in the range 1 kw, single phase to 10 kw, 3 phase.

The third 60 cycle line involves the basic 60 cycle generator, and a special overhung amplidyne exciter, and a static voltage regulator, all wrapped in one package. This line is applicable where close voltage regulation and excellent motor starting ability is required. Engineers explain that regulation is plus or minus 2 per cent at rated 0.8 pf.

In the packaged design, the regulator, which has no moving parts, is installed completely adjusted at the factory. To give the

Continued on Page 48

IT'S TIME TO "TOOL-UP" YOUR ENGINEERING

Design changes on consumer products to eliminate critical materials—designs for new defense items—new shop layouts to speed defense production—all call for new drawings—fast. To achieve the drawing speed demanded by today's industrial needs, "tool-up" your engineering—equip every drawing board with a Universal Drafting Machine.

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engine manufacturer or assembler a small degree of flexibility at the time of assembly of the complete engine generator equipment, a small fast acting snap switch with screwdriver slot is mounted underneath the spun cover. This provides taps for adjustment to plus 5 per cent, zero or minus 5 per cent variation from rated voltage. This may be utilized if the engine regulation is abnormal or spiral application factors exist. The packaged line is available in the same ratings as the basic line, that is, 2 kw, single phase through 15 kw, 3 phase.

The high-frequency, 14-pole, synchronous generator is the 4th design in the line. Suitable for applications which require 400 cycle power, the 14-pole unit is designed for military ground power engine- or motor-generator sets, testing laboratories, textile mills, etc., according to G-E engineers. The units are also applicable in frequency changer equipments driven by 3500-rpm motors. These are available in ratings 2 kw, single phase through 40-kw, 3 phase at 3428 rpm.

* Registered trade mark of the General Electric Co.

Dumitter Joins Camera With TV Receivers In Closed Circuit

An entirely new concept of closed-circuit television is provided by the new addition to the Du Mont television equipment line, the Dumitter. This unit, just announced by the Television Transmitter Division, Allen B. Du Mont Laboratories, Inc., Clifton, N. J., permits TV camera signals to be distributed to a large number of standard TV receivers, over connecting cables, thereby eliminating costly and bulky equipment heretofore required for the same function.

The Dumitter is a single, compact, completely portable unit. It takes the composite video signal from any standard TV camera chain and feeds it via cable to the regular antenna terminals of any standard TV receiver. All the advantages of regular TV transmission are retained through the use of a carrier signal of the frequency of either TV Channel 2 or 3, optional on the Dumitter controls. The equipment is stable and requires no operator. Both video and aural signals are fed through a single coaxial cable. Up to 125 receivers can be driven simultaneously with clear, better-than-average pictures. Due to the carrier frequency used, attenuation in the feed line is not serious, and no special termination is needed for equalization. Transmission is excellent over several thousand feet.

Each receiver is tuned to either Channel 2 or 3, depending on the setting of the Dumitter, and the closed-circuit program is received. The antenna lead-in is disconnected from the receiver while the Dumitter signal is being received. Simply switching from Dumitter line to antenna lead-in permits the receiver to function on either closed-circuit or standard telecasting at will. No circuit alterations or component changes are required in the standard TV receiver for Dumitter reception.

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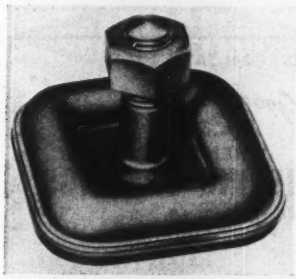
Since the Dumitter signals travel through coaxial cables, reception is free at all times of outside interference. No license is required, since the transmitter does not radiate.

With such factors as low cost, complete flexibility and outstanding performance, the Dumitter will find many applications in closed circuit television. An immediate usage is in the TV studio for feeding programs to a number of monitors for previous and private showings to clients. The Dumitter has a place in television for industry, inasmuch as it can distribute color as well as monochrome signals. It can also fill an important need in field demonstrations of TV receivers. For merchandising promotions, it can distribute the camera picture to standard TV receivers located at strategic spots throughout the largest store.

Gaskets and Seals

Maintaining perfect seals for boiler handhole and tubecap cover assemblies at a minimum maintenance cost is now possible with the application of Flexitallic Style T Gaskets, made by Flexitallic Gasket Co., Eighth and Bailey Streets, Camden 5, N. J.

Flexitallic Style T Gaskets require no compounds and can frequently be reused if not removed from cover assemblies during outage. This economy is due to the exclusive feature of Flexitallic Spiral-Wound conconstruction—the spiral winding of V-crimped plies alternated with plies of filler. The V-crimp gives the metal strip a strong, resilient action. This resiliency permits the gaskets to rebound when they are not under compression.



Style T Gaskets are available in two thicknesses: .125″ for use with assemblies having narrow seating surfaces and high bonding loads; .175″ for use in assemblies having broad seating surfaces and low bonding loads.

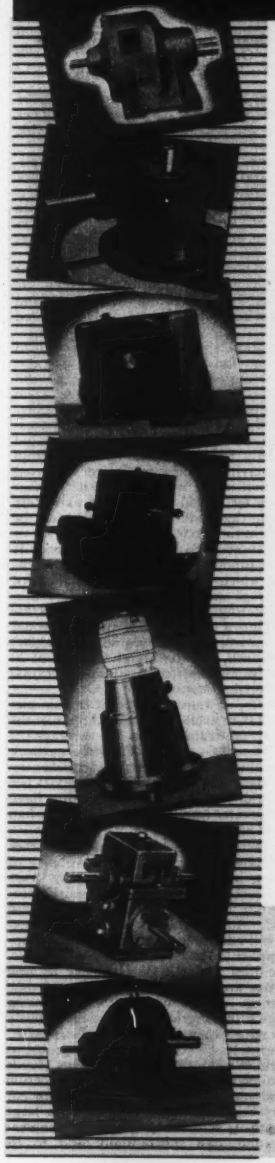
Flexitallic Style T Gaskets are recognized for the following design factors: yield values and bonding loads proportioned to safe stresses of cover assemblies; resiliency under concentrated and fluctuating loads; exceptionally long and sustained service, and reduction of seat cleaning time.

Standard Style T Gaskets are available in the following three ranges of operating pressure for practically all makes of boilers and auxiliary equipment: 0–499 lb.; 0–999 lb.; 1000 lb. and above. Gaskets are manufactured of low carbon plated steel and Canadian asbestos filler and Type 304 Stainless Steel and Canadian asbestos filler for all ranges of operating pressure. Low carbon plated steel serves well in a majority of applications where saturated temperatures do not exceed 500° F. Other fillers can be furnished in combination with any ferrous or

Continued on Page 50

Shorten the interval between design and assembly line with

WINSMITH Standardization



Huge military and domestic needs place increased emphasis on design speed-ups and production simplification.

This calls for maximum standardization. One way to achieve it, where power transmission problems are involved, is with Winsmith speed reducers. For, no matter how individual the purpose, how specialized the function, how complex the design and production problems, most requirements can be served with standardized Winsmith reducers.

With industry's widest range of standard designs and sizes from fractional to 85 H.P., Winsmith can meet your normal and special demands . . . can help you shorten the interval between machine design and assembly line.

And a Winsmith power transmission engineer in your locality is available for consultation.

DESCRIPTIVE FOLDER, "Save through Standardization," will aid in your selection. Write.

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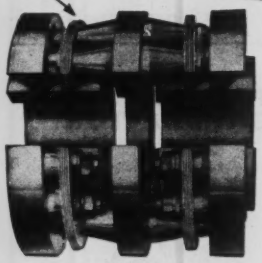

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NO MAINTENANCE PROBLEMS.
ALL PARTS ARE SOLIDLY BOLTED TOGETHER.

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non-ferrous alloys where the use of such materials is indicated.

Type 304 Stainless Steel has ideal corrosion resistant qualities, extremely long life and is recommended for superheat temperature.

Flexitallic Style T Gaskets are also available for non-standard handhole and tubecap cover assemblies, and can be designed and manufactured to meet specific temperatures and pressures and to resist severe corrosion

American Copper Industry Needs Orderly Changeover To Retain Skilled Labor

Detroit—A continued orderly changeover to defense production is necessary if copper fabricators are to retain their irreplaceable labor force.

On January 1, the amount of copper available for civilian consumption was cut back 15 per cent, and a 20 per cent cutback is scheduled for March based on the first six months of 1950. Current defense orders have offset only part of the production curtailment.

Full production must be maintained in the coming months if fabricators, such as Wolverine Tube Division of Calumet and Hecla, are to protect their supply of skilled labor.

Fabrication labor is the most highly skilled in American industry and the hardest to get. If a skilled workman has no work he will naturally go some place else and later, when needed, may not be available for re-employment. Management is aware of the necessity to adjust to defense production in a rapid and orderly fashion to take up the slack in curtailed civilian production in order to avoid competition in the open market with other industries for skilled labor. It is extremely important that sufficient defense orders be available in time to fill the gap.

For instance, the Government cutback is based on production in the first six months of 1950, which were generally slow months. The average monthly consumption by fabricators during this key period was 118,000 tons. Thus a cutback of 15 per cent would permit an average consumption of 100,000 tons a month, and the March cutback of 20 per cent would limit consumption to 95,000 tons for civilian use.

However, an important point in this picture is that in each of the last three months of 1950, fabricators used an average of 130,000 tons of copper. Thus the cutback in non-military use in January and February is not a basic 15 per cent, but is about 25 per cent. Additional cutbacks would thus have a much greater impact on employment than is at first apparent.

Because of the heavy requirements of other western powers, there is little possibility of increasing imports of foreign copper. Various projects for expanding domestic production are being submitted to the Defense Minerals Administration and these eventually will add some tonnage to present copper supplies. However, expansion of existing facilities and the development of new properties are necessarily gradual and time consuming. Furthermore, the increasing shortage of underground labor will seriously impair mine expansion in many districts.

Nevertheless, in the present emergency, as in World War II, Calumet and Hecla stands ready to do its utmost to increase production of metal and metal products required for our military machine. The company has large low grade ore reserves and, with Government cooperation, can substantially add to its present output.

MERCOID CONTROLS

Designed to automatically regulate electrically operated equipment in accordance with changes in temperature, pressure, vacuum, fluid level or mechanical movement. Equipped exclusively with corrosion-proof mercury switches.

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POSITIVE SAFETY • YEARS OF DEPENDABLE PERFORMANCE
EASE OF INSTALLATION • CONVENIENT ADJUSTMENTS

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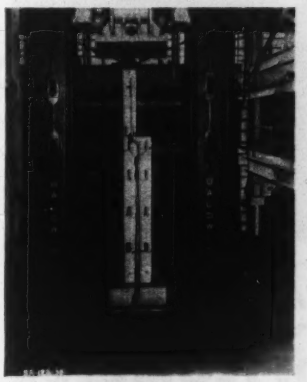
The Wolverine Tube Division of Calumet and Hecla is converting rapidly to defense production and is in a position to supply large quantities of non-ferrous tube products for military purposes.

Baldwin Load Testing Equipment

The largest and the smallest test loading and load measuring equipment known were used together recently by the U. S. Bureau of Reclamation to determine the load-carrying capacity of a reinforced concrete step-column 22 feet high, its weakest point under load, and the stresses and strains at numerous points on the surface and within the column.



The illustration shows the load being applied to the pilaster in the Bureau laboratories at Denver, Colo. No load was applied to the step. It took but little more than one-third of the 5,000,000-lb. loading capacity of this testing machine to cause failure. This took place immediately above the step under a load of 1,675,000 pounds. Failure occurred through buckling of the longitudinal reinforcing steel, accompanied by shear and compression failure of the concrete.

During the application of the increasing load, Baldwin SR-4 resistance wire strain gages, bonded to the concrete surface of the column and internally on reinforcing bars, measured the stains occurring at many points on the column by the change of electrical resistance in the wire grid. By means of a nearby Wheatstone bridge and amplifier circuit these changes were translated into inches of deformation per inch of length.

This test is typical of many to be undertaken by the Bureau on concrete structures, both full size and models. The column illustrated was designed for use in Bureau power plants.

New Variable Speed Series Announced by Worthington

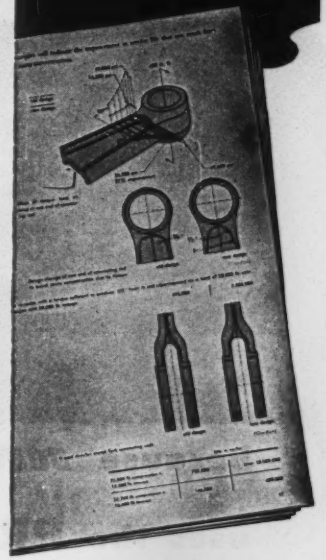
A new variable speed transmission series, incorporating the Worthington tandem belt design, has been announced by Frank J. Whelan, Vice President of Worthington Pump & Machinery Corp.

The new line, known as the Worthington Allspeed Drive, will consist of six models, rated at 1, 3, 5, 7½, 10 and 15 h.p. respectively and will offer variations of 16 to 1, 10 to 1, 9 to 1, 8 to 1, 6 to 1 and 6 to 1 respectively. At 1725 r.p.m. input, the 1 h.p. unit offers a range of 215 to 3450 r.p.m.; while the 15 h.p. unit will vary from 370 to

Continued on Page 52

WHAT ABOUT STRESS RAISERS?

This book gives the answers..



How to avoid the localized stresses which start failure is a basic problem of design. This 72 page booklet analyzes many good and bad features of design. It also deals with problems of steel selection and treatment from the viewpoint of the design engineer —instead of the metallurgist.

Write for "3 Keys to Satisfaction"—it is free.

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Profilometers are in use constantly for production control of machining operations at Douglas Aircraft Company's plant in Santa Monica, Calif. In many instances, Douglas found that surface roughness ratings could be held well within engineering specifications even after machining time was reduced considerably.

Here is a typical example. The milling operation on one surface of the aluminum part illustrated—and which is produced in fairly high volume—had been run with a feed of 21 inches per minute. This produced a surface roughness rating of 40 microinches. For this part, a 100 microinch finish was specified as maximum. After increasing the feed to almost 50 inches per minute, it was found that the finish still was entirely satisfactory. As a result, machining time for this operation was decreased by more than half!

It is interesting to note that, at Douglas, Profilometers serve a number of departments. They may be used by inspection, by the production standards department or by production departments near the machines on which the surfaces in question are being produced. Douglas recognizes the Profilometer as a *shop instrument.*

To learn how the Profilometer can help cut costs in your production, write today for these free bulletins.

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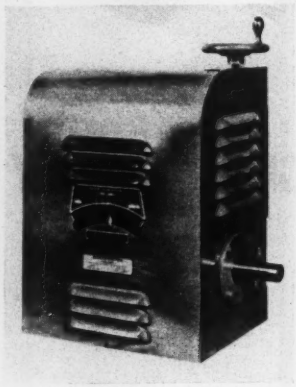
2220 r.p.m. with an input speed of 1750 r.p.m.

Due to the tandem belt design, the Worthington Allspeed Drive is particularly suited to applications where space limitations require extreme compactness. Upon advance specification each of the units will be furnished for vertical or horizontal operation, to run in either direction.



Handwheel control will be normally furnished. Electrical Remote Controls are available where required.

Among the latest features in the new models are wide spaced bearings which maintain the input and output shafts in true alignment, regardless of belt tension load. All rotary motion in the unit is carried in shielded ball bearings, lubricated for life. All sliding fits are made with easily removable bronze composition bushings. Bearings on both the input and output shafts are locked to provide for a thrust load.

New type self-cooling belts are provided, and when necessary belts can be readily changed without disconnecting the unit from other equipment.

Available as a "packaged" unit, with built-in NEMA standard motors, or modified to suit specific requirements.

Further information may be obtained from Worthington Pump & Machinery Corporation, Allspeed Drive Division, Holyoke, Mass.

G-E Motors Power Compressors in Hypersonic Wind Tunnel at Cal Tech

Speeds of more than ten times the velocity of sound are being obtained in the recently completed hypersonic wind tunnel on the campus at the California Institute of Technology, Pasadena, California. Powered, principally by the General Electric motors, the tunnel was designed and built for the Institute and the Army Ordnance Department, to provide vitally needed information for use in the design of future missiles at speeds well above those of present day rockets and missiles.

The new tunnel, called "hypersonic" because of the terrific air speeds attained, has been operated at higher than Mach 10. (A Mach number of one represents a speed equaf to the speed of sound which is approximately 760-mph at sea level.) The Ordnance-Cal Tech tunnel operates continuously during experiments and air velocities of Mach 10 can be obtained for any length of time desired.

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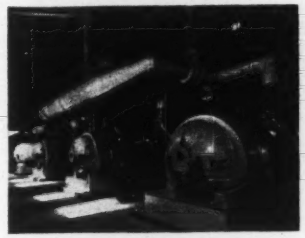
The test section, in which models are mounted, is only 5 by 5 inches, although the entire tunnel has an over-all length of four feet. This includes a region of acceleration downstream from the nozzle throat, the test section, and the diffuser section, where the process of slowing down the air takes place.

To accelerate in the expansion section, the air must pass through a slot in the throat of a specially designed steel alloy nozzle. The height of the slot depends on the Mach number desired. Thus, at a speed of Mach 10, air at tremendous pressure blasts through a tiny slit less than 5/1000 of an inch high, or approximately the thickness of a sheet of paper. When the air suddenly expands into the test section, the temperature drops to about 430 degrees below zero F, while the pressure drops to about one millimeter of mercury, or 1/1000 of normal atmospheric pressure.



Air, at pressures as high as 1000 psi, is provided by rotary vane type and double-acting reciprocating type compressors. The piping arrangement of the compressors can be varied by a system of valves to provide series or parallel compression.

The compressor room, located in the basement immediately below the tunnel, also houses the General Electric motors which drive the compressors. Two 150-hp, 600-rpm motors drive eight rotary compressors, four in tandem to each motor. One 200-hp, 600-rpm motor and one 75-hp, 600-rpm motor each drive two more rotary compressors mounted in tandem. Two 100-hp, 1180-rpm induction motors are belt connected to drive the remaining two compressors.

Yale & Towne Rescheduling under NPA

Chicago, Ill.—The production of Yale locks and builders' hardware for consumer use is in process of sweeping rescheduling at the Stamford Division of The Yale & Towne Manufacturing Company in an effort to get maximum output of its products from those critical metals which have been restricted by government order. This was stated here by Raymond K. Watkins, Yale & Towne's trade sales manager at the opening of the annual convention and exposition of the National Association of Home Builders at the Stevens Hotel.

According to Mr. Watkins' announcement, production of certain lines of Yale locks and builders' hardware will be stepped up, while other lines will be suspended during the national emergency.

It was stated that the Company's production of popular residential tubular locks will be concentrated entirely on a completely new line to be marketed as Yale's Home Duty Tubular Locks. These new Yale Home Duty Tubular locks will be manufactured in four different models, offering locks for every ordinary residential need.

Continued on Page 54

As one of the leading soap manufacturers on the Pacific Coast, the Pacific Soap Company has always believed that "the best equipment pays more" in results and service. That's why they asked Peabody to design a unit that would permit their detergent to be produced absolutely clean, undiscolored, and of a constant, high quality.

To do this, Peabody Engineers designed a 10,000,000 BTU/per hr. Direct Fired Air Heater with a specially-constructed Peabody Type "M" Burner that fires either oil or gas. It is with sincere pride that Peabody adds the name of Pacific Soap to the long list of prominent concerns using Peabody equipment.

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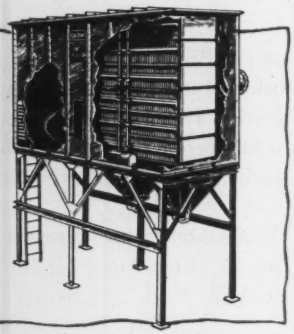
OFFICES IN PRINCIPAL CITIES

190

* At the Kellogg Company of Battle Creek, Mich., this Pangborn Dust Control system salvages 35 tons of valuable dust per day. Collected from the corn mill and the Gro-Pup building, the dust is valued at $40 a ton . . . building a profit of *$1400 a day* for Kellogg!

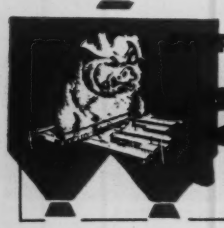
Here's how Pangborn makes Dust Control *profitable* for industry!

Pangborn Dust Collectors make low-cost dust control possible. As this cutaway shows, type "CH" Collectors are compact, offer maximum filtering area in a given size. Filter life is prolonged because dust-laden air passes through collector at low velocity. Efficiency is extremely high; in fact, clean exhausted air can often be returned direct to plant.



FIND OUT how Pangborn Dust Control *turns dust into profits.* Write for a copy of Bulletin 909A to: PANGBORN CORPORATION, 2200 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the latest developments in Dust Control and Blast Cleaning Equipment



THE DUST HOG from stealing profits with

Pangborn

DUST CONTROL

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In revealing Yale & Towne's program to maintain a high level of production of this type of widely-used residential lock, Mr. Watkins told home builders and building contractors attending the NAHB convention that it " is part of the company's program to supply the construction market with locks and finishing hardware to the fullest extent possible under current National Production Authority limitations."

Preview samples of the new Yale Home Duty Locks were put on public display for the first time at the Yale & Towne exhibit, and visiting builders were shown the many new features contained in these new locks, including a new, exclusive, patented locking device. By actual demonstrations, the builders were shown how the new locks reduce costly installation time thereby reducing installation costs.

Mr. Watkins also disclosed that Yale & Towne has just published for all of its customers throughout the United States an analysis of the effects of NPA rules and regulations on available supplies of Yale locks and builders' hardware. According to this analysis, NPA restrictions affecting Yale locks and builders' hardware production are defined in Regulation 1; in Regulation M-7, affecting aluminum; Regulation M-12 referring to copper and brass, and the recent Amendment 1 to M-12 which limits the end use of copper and brass; Regulation M-14 restricting nickel; Regulation M-15, restricting zinc; and Regulation M-19, restricting cadmium.

Because of these NPA metal restrictions, Yale & Towne has completely revised its list of lock and hardware products, according to Mr. Watkins, who said "taking a realistic view of present material shortages and NPA limitation orders, the list has been reduced to those items which we can reasonably be expected to produce in volume."

Mr. Watkins also said that Yale & Towne has given its customers "a completely comprehensive picture in one fell swoop of the product situation so that they may have a four or five month period in which to balance their inventories."

As an example of the effects of National Production Authority rules on the production of Yale locks and builders' hardware, Mr. Watkins pointed to the suspension by the Company of two lines of residential tubular locks "because of re-scheduling of materials by mills," and the curtailment of another line in this class of product, "because of the shortage of zinc."

"We have therefore decided," Mr. Watkins said, "to concentrate our production of residential tubular locks on our new Home Duty Tubular Line.

"By concentrating our production on this one new line, we hope to be able to have a bigger supply of tubular locks, and since the new Home Duty Line is universal in application, it should effectively serve the needs of home builders in general."

Mr. Watkins also said that production re-scheduling involves every other class of Yale locks and builders' hardware, and has been undertaken toward the same end "of getting the most volume out of available metal supplies.

"The chief purpose of all of Yale & Towne's decisions resulting from NPA rules," Mr. Watkins said, "is to make it possible for all our customers to continue doing business in the difficult days ahead with as little disturbance as possible.

"Actually, we are trying to set up a production program on the basis of the situation as we believe it will be five and six months hence," he said. "Under this program, the products that will be available will give our

• Keep Informed

customers the means to carry on their normal business as long as conditions permit us to manufacture these products and in strict compliance with NPA curtailment orders."

Mr. Watkins also stated that Yale & Towne will begin "to allocate Yale locks and builders' hardware to all our customers on an equitable basis."

New Monogas Generator Available

A new Monogas generator has been added to the line of protective atmosphere equipment manufactured by the Westinghouse Electric Corp.

Monogas is a non-decarburizing, neutral atmosphere; it consists essentially of nitrogen, with low hydrogen and carbon content, and with carbon dioxide, oxygen, and water vapor removed. It usually is produced by scrubbing carbon dioxide from an Exogas atmosphere, a process requiring both an Exogas generator and a CO_2 scrubber.

The new Monogas generator unit is "packaged" to include the generator and scrubber as one unit. As a result, the waste heat of combustion in the Exogas generator is utilized in reboiling the CO_2 scrubbing chemical. This elimination of an outside heat source increases considerably the operating efficiency of the unit.

The packaged unit reduces floor space requirements to a minimum. Installation also is simplified since much of the usual on-the-job pipe fitting is eliminated. Units are available in sizes ranging from 500 through 15,000.

For information, write the Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

General Electric Announces Huge Jet Engine Center Established at Lockland, Ohio

The General Electric Co. has announced that a vast aircraft jet engine and turbo-prop test, development, and production center will be established at Lockland, Ohio, near Cincinnati to meet increased military needs for G-E engines.

C. W. LaPierre, manager of the company's Aircraft Gas Turbine Divisions, disclosed stepped-up production will be achieved by:

1. More than tripling the space now occupied by G. E. in the large Lockland plant where Wright piston engines were made in World War II. This will be done through purchase, lease, and new construction.
2. Establishing facilities for the manufacture of jet engine components at Lockland.

Continued on Page 56

4 things to look for when you need a new black-and-white print machine

NO EXHAUST DUCTS. Bruning BW machines do not use a vapor developer nor emit fumes, thus they need no exhaust ducts. You merely roll them on their casters to wherever they are needed, connect them to your electric circuit and they are ready to make prints.

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- **Protect piping against strain, stress, settling, shock, or vibration! Excellent for outside service piping connections to buildings, large storage tanks.**

COMPLETE LINE—15 different sizes, ¼" to 12". Angle or straight, male or female threaded connections—flanged connections—welding ends for welded connections. Available in materials suitable for temperatures from −50° to as high as 1,000° F.; for pressures from vacuum to 750 p.s.i. steam, or 6,000 p.s.i. hydraulic. Fire-proof, pressure-safe! Standard throughout the world—available through leading supply companies.

ENGINEERING RECOMMENDATIONS—Barco factory and field engineers are ready to help you solve your problems. ASK FOR NEW CATALOG NO. 215 "BARCO FLEXIBLE BALL JOINTS."

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The Only Truly Complete Line of Flexible, Swivel, and Revolving Joints
FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

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The company in the past has not manufactured parts at Lockland but has assembled complete engines from components supplied by more than 280 sub-contractors throughout the United States. The company's own components manufacturing facilities, operating at capacity at Lynn and Everett, Mass., will be augmented by the new Lockland facilities.

3. Greatly increasing the present jet engine assembly operation by increasing the capacity for the manufacture of components from subcontractors.

"In brief, we are greatly expanding our facilities to assemble engines at Lockland and at the same time are adding some manufacturing facilities there, together with space for development and for our engineering, commercial, and executive staffs," LaPierre said.

He announced that the multi-million-dollar expansion of facilities at Lockland will involve:

Purchase of the "North Shop" of the former Wright plant. For the last two years General Electric has been leasing this space from the Electric Auto-Lite Company, Toledo, Ohio.

Leasing of additional space in the "South Shop," owned by Electric Auto-Lite.

Purchase of an 80-acre tract, across Jimson Road from the "North Shop," from the Pennsylvania Railroad, and construction on the tract of a two-story office building and a factory building.

The lease of additional unused space in the former Wright plant from the government. This is currently under negotiation but will include at least part of the three government-owned foundry buildings.

LaPierre previously had announced that the divisions' executive, engineering, and commercial staffs would be moved to Lockland to ease overcrowding in the company's River Works at Lynn. He said the Lynn and Everett plants would continue to operate at capacity for turbojet and turbosupercharger manufacture, assembly, and test; for turbosupercharger engineering; and for advanced engine component testing in the new $4,000,000 aircraft gas turbine laboratory at Lynn.

New construction at Lockland will start as soon as possible, probably soon after Jan. 1, he said. Design and construction of the new facilities will be supervised by the General Electric Realty Corporation which has engaged Giffels and Vallet of Detroit as architects for the factory and office buildings. The new engine test facilities are being designed by Jackson and Moreland of Boston. The general construction contract has been let to the Duffy Construction Corp. of Cleveland, Ohio.

LaPierre pointed out that purchase of the "North Shop" and construction of the new factory and office buildings provides a permanent nucleus for long-term development and production of engines by the General Electric Company.

"I am convinced that the provision of adequate development and production facilities and trained personnel for the manufacture of jet engines is necessary. Our expansion program places emphasis on development as well as on production."

General Electric will finance purchase and construction of the new development facilities, including test cells, machinery, and equipment.

The company's current jet engine and turbosupercharger facilities in Lynn and Everett encompass more than 1,000,000 square feet of floor space. The "North Shop" at Lockland has more than 650,000 square feet of

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space. The new office building will have 120,000 square feet and the factory buildings 300,000. Additional leased space will total more than 1,000,000 square feet.

The Air Force's No. 1 production jet engine, the company's J-47, powers such planes as the North American F-86, world's speed record-holding fighter; the North American F-86D, an even speedier interceptor version; the six-jet Boeing B-47 bomber; the four-jet North American B-45 bomber; and the Convair B-36 intercontinental bomber to which four jets have been added to augment power supplied by the six piston engines. The J-47, which provides more than 5,200 pounds of thrust or driving force, also powers such experimental planes as Republic's XF-91 interceptor and Martin's three-jet XB-51 bomber.

Multiple Discharge Tracks Increase Capacity of Parts Feeders

Adaptable to the handling of many types of parts, ranging in size from tiny rivets to mower blades, the feeding capacity of Syntron Vibratory Parts Feeders can be doubled or tripled by equipping them with two or three feeding tracks instead of only one as they were originally furnished. The movement of parts is in the same direction on all tracks and the discharges may be located all at one point (as illustrated) or at various points around the cirumference of the bowl, convenient to the processing stations.

Thus, the two or more tracked Parts Feeders not only increase the rate of feed, but also permit the use of more processing stations, more counting devices, etc.

The smaller Models EB-01 and EB-1 can be furnished with two feeding tracks while the larger Models EB-2, EB-4 and EB-5 can be equipped with up to four feeding tracks.

Information is available from Syntron Co., 498 Lexington Ave., Homer City, Pa.

More Starting Torque for Split-Phase Motor

A fractional horsepower motor having a greater starting torque than the standard split-phase motor was required, but the Westinghouse designer was reluctant to use the capacitor motor because of its higher cost. He licked the problem by using steel wedges in the slots not occupied by the starting winding. This increases the leakage reactance of the running-winding circuit and has the effect of widening the phase angle between the currents in the starting and running winding, which is one of the determining factors in the amount of starting torque developed by a split-phase motor. Use of magnetic slot wedges reduces the maximum or pull-out torque, but this is compensated by altering the turns of the running winding.

Continued on Page 58

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- Excellent for non-interference shielding and for housing of sensitive electronic equipment.

ElectroShield is a ductile rolled sheet metal that's easily fabricated by the common methods, including *resistance welding, soldering, brazing,* stamping and drawing. Because it is strong as steel, *ElectroShield* often can be used in lighter gauges than copper. It can be used just about everywhere the heat conductivity or corrosion protection of copper is needed. It is produced in hot and cold rolled sheets, standard mill size, light and heavy gauges.

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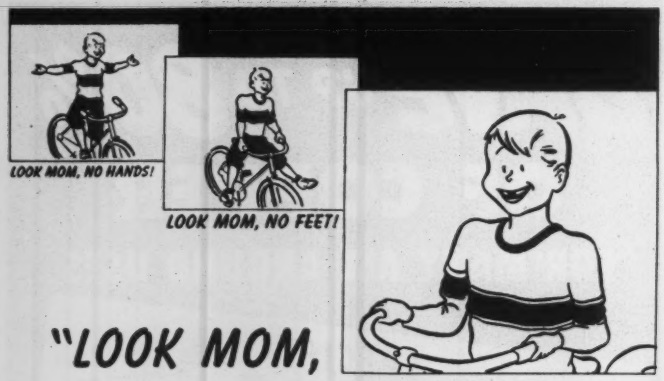

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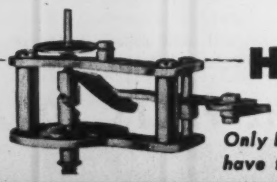

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AMERICAN CHAIN & CABLE COMPANY, INC.
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TRADE MARK

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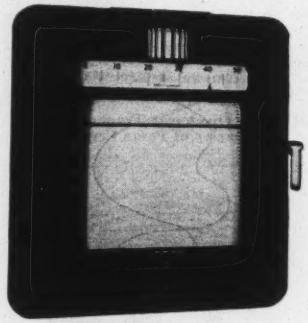
New 2-Pen Recorder

New 2-pen Speedomax electronic recorder announced by Leeds & Northrup Co., Philadelphia, records two functions simultaneously against time. The instrument saves tedious compilation and point-by-point plotting of data. Since both functions are drawn as continuous curves on a $9^{7}/_{8}$" wide chart, users can follow swift-changing variables with ease.



Two separate electronically-amplified measuring circuits, two balancing motors, and two recording pens are all housed in one standard Speedomax case. Circuits can be supplied to work with thermocouples, Thermohms, strain gages, tachometers, thermal converters, pH cells, or most other types of primary elements. The instrument can operate controls or alarms.

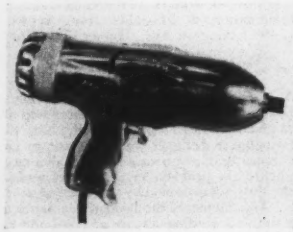
Recording pens operate overlapping or side-by-side, either across full scale or a specified portion of the full width. Speed of response for full-scale pen movement is 3, 2 or 1 second, as specified.

Chart speed—the Y or time axis—can be selected in the range of 1 to 1800 inches per hour. To aid in identification, the instrument draws one curve in red ink, the other in black. Index pointers are red and black to correspond.

Any standard single range applicable to Speedomax G may be selected. The same range can apply to both pens, or the ranges may be different.

For full details, write to Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa.

Mall Impact Wrench



The Mall Tool Co. has begun full production on a new portable electric impact wrench. This versatile tool applies and removes screws, studs and nuts—it has proven ideal for nut running up to $^{1}/_{2}$ inch bolt size. Model 2EW will also drill, tap, ream and extract broken capscrews or studs plus drive wood augers, hole saws and wire brushes

quickly and effectively. Designed for easy one hand operation for automotive work, steel construction and all-around industrial jobs, this 11 inch, 7 pound unit is good for use in close quarters. A new pistol grip and trigger switch allows better control and instant response.

Model 2EW is powered by a reversible, air-cooled universal motor for operation on 115 volt AC-DC current—model for 230 volts also available. The impact hammer is mounted on an anti-friction bearing that eliminates kick and twist in the hand. Housing is made of die cast aluminum alloy for lightness and durability. U.L. Approved. Manufactured by Mall Tool Co., 7725 South Chicago Avenue, Chicato 19, Illinois.

• BUSINESS CHANGES

Du Mont Tube Division Initiates Intensive Distributor Promotion Program

Promotional support to Teletron Distributors has been expanded considerably by the Renewal Tube Sales Department, Cathode-ray Tube Division of Allen B. Du Mont Laboratories, Inc.

A new program offers more direct-to-serviceman coverage on a national scale. More mail and counter pieces, in turn, are being supplied to the distributor for his own use. Bi-weekly notices inform the distributor of product news, technical information, national advertising campaigns, and important policies.

The field organization considers the bi-weekly notices to be most important and contributory to its welfare. In these unsettled times of contingent shortages and expected curtailments, the need for informing the field of conditions at home is a prime one.

Worthington Acquires National Transit Pump & Machine Co. Property in Oil City

Oil City, Pa.—E. J. Schwanhausser, Executive Vice President of Worthington Pump & Machinery Corp., Harrison, N. J., announced recently that Worthington has acquired the land, buildings, and equipment of National Transit Pump & Machine Co. in Oil City, Pa., which is in process of dissolution, and the sale of these assets is in connection therewith.

Mr. Schwanhausser said that this Plant, covering about 500,000 square feet, will be utilized by the Corporation in furtherance of its production of equipment related to the National Defense Program.

It is expected that Worthington will take possession of the plant early in February and commence operations on or about that time.

Mr. Schwanhausser said that Worthington was most happy to find this location in Oil City and that by acquiring this Plant the community would be assured of the continued operation of this industrial property which should be beneficial to the City and its environs. In this connection it was noted that Mr. Jay Levine, who is presently Executive Vice President of National Transit Pump & Machine Company, had previously stated,

Continued on Page 60

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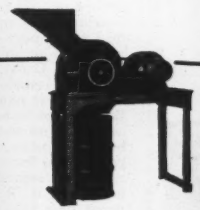
"30" Series Hammermill. Capacities to 100 TPH.

"24" Series—ring or hammer crushers. Capacities to 50 TPH.

Laboratory Mill—for testing, pilot plant operation—and waste reduction.



"KC" Plastics Grinder—reduces thermoplastic sprues, rejects. Capacities to 450 lbs. per hour.

"AC" Ring Mill. With American's exclusive shredder rings—for high tonnage, uniform reduction. 500 TPH capacity.

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Draws a line 1/10th of a mile long with 1 filling!

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Yes, even fine lines are obtained without breaks and without running with these superb inks backed by 112 years of quality manufacture. Absolutely waterproof; free-flowing; will not dry in ruling pen. Intense, opaque black and 19 clear, brilliant colors, blendable and dilutable. In 1 oz. bottles, handy cartridges and larger containers.

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Faster – Safer–
THE REDESIGNED
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PUL-PAC
"Where it's applicable, it's unbeatable"
A hydraulically-operated pantograph-type linkage extends and retracts the pusher-rack and gripper-jaw, with these important advantages:
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• elimination of bending forces to which old-type longer piston was subject
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A great money-saver since the day it was introduced, the PUL-PAC eliminates the conventional space-consuming pallet and handles unit loads assembled on low-cost carrier sheets. Today's redesigned PUL-PAC does that job more efficiently and more profitably. Simpler, sturdier, faster, safer, it reaches new heights as a money and manpower saver.
The PUL-PAC method might be the most efficient, the most economical for your operation. Check on it with your Clark Dealer —he's listed in the yellow pages of your telephone directory. Or send the coupon, attached to your business letterhead, for PUL-PAC literature.
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MATERIALS HANDLING EXPOSITION
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AND POWERED HAND TRUCKS • INDUSTRIAL TOWING TRACTORS
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on behalf of his Company, that in negotiating the sale of this property every endeavor would be made to find a purchaser who would continue to operate the facilities. Mr. Levine said that the sale of the property to Worthington had made possible the fulfillment of this obligation to the community.

In order to acquire immediate possession of the property which is needed for its operations, Worthington has also purchased some of the inventory of National Transit Pump & Machine Co. and will therefore be in a position to furnish repair and spare parts for the products of National Transit Pump & Machine Co. now in the field. Accordingly, customers of National Transit Pump & Machine Co. will not be left without a source of parts supply even though that Company is expected to continue its dissolution and liquidation.

Link-Belt Opens Plant in South Africa

Link-Belt Company announces that its wholly-owned South African subsidiary, Link-Belt Africa Limited, incorporated last January, has purchased a 12,000-sq. ft. manufacturing plant, with separate office building, on a 12-acre plot in Springs, Transvaal, about 28 miles east of Johannesburg, for the purpose of manufacturing conveyor machinery and other Link-Belt products commonly used in South Africa.

Mr. John E. Petersen has been appointed managing director of the South African company. Mr. Petersen was formerly divisional engineer at the company's Pershing Road plant in Chicago, where he started as a draftsman in 1934. He was graduated from the University of Chicago in liberal arts, and gained his technical education at the Illinois Institute of Technology.

Mr. Gene Zwerner, heretofore Link-Belt district sales engineer at Detroit, has been appointed sales manager of Link-Belt Africa Limited. Mr. A. L. Endroll, who last served as district sales engineer at the company's Atlanta plant, is transferring to South Africa to supply additional manufacturing and engineering experience.

Link-Belt Company does a world-wide business in elevating, conveying and mechanical power transmission machinery, with total sales of approximately $100,000,000 annually.

Revere Sesquicentennial

Many companies and communities will join with Revere Copper and Brass Incorporated in a celebration, during 1951, of the founding of the copper fabricating industry in the United States by Paul Revere in 1801, according to an announcement authorized by C. Donald Dallas, chairman of the board of the Revere company.

The copper manufacturing company which Paul Revere founded, continued in business until 1928, when it was one of six copper and brass fabricators to join in the Revere Copper & Brass Incorporated merger. The Revere family retired from active management, but E. H. R. Revere, a direct descendant (great grandson) of Paul Revere, has remained a director of the present Revere concern.

Thus, the announcement pointed out, the present company is able to celebrate in 1951 the Sesquicentennial of its founding by the great patriot. But because of the wider significance of Revere's establishment of the first successful copper mill in the United States, the Revere company prefers to invite others to join in the celebration of this pioneer industrial event, it was said. The announcement continued:

"Noted as a patriot, hero of the ride to

• Keep Informed

rouse the Minute Men against the British in 1775, and admired also as an artist in silverware, Revere's industrial accomplishments are less well known but are even more solid claims to immortality, in the opinion of historians and industrialists.

"A many-sided man, Revere in the 18th century cast bells of bronze that still ring in churches and town-halls of New England. He made dentures and engravings of copper. But he did not know how to 'work' copper, nor did anyone in the United States in Revolutionary times. As late as 1800 copper sheathing, bolts and spikes, considered essential for most types of merchant and naval vessels, had to be imported from England.

"Paul Revere's aid was sought in 1797 when bolts imported for the building of 'Old Ironsides' proved to be the wrong size. He solved the problem of how to reshape them and went on to a larger project: the building of a mill for rolling copper for sheathing.

"The story of his struggles to learn a secret unknown here, of how he won his first order from the Navy and raised the capital to start his mill in Canton, Mass., and his eventual success with his manufacturing process is one of the epics of American industry. It is known that Revere turned out copper sheets for the first time in the fall of 1801."

Revere was 67 in 1801, but still vigorous and enterprising. The letters and accounts of his business, still available in museums, company records, and the archives of the United States, have yielded much evidence of his stature as an industrialist, it was reported.

American Engineering Sales Changes

Effective January 22nd, 1951, the American Engineering Co. of Philadelphia, Pa., is being exclusively represented on two of its products . . . Hele Shaw and Hydramite Pumps . . . by Compressed Air Products, 400 Third Ave., Brooklyn, N. Y.

Mr. Walter R. Ellis with headquarters at the above address will handle New York and New England. Mr. Addison T. Smith with headquarters at 1977 Springfield Avenue, Maplewood, N. J., will cover New Jersey.

Both men have had many years of experience in the Hydraulic field cooperating in the formulation of hydraulic circuits and in the selection of their components.

For further information contact: American Engineering Co., Aramingo Avenue and Cumberland Street, Philadelphia 25, Pa. or Beatty and Oliver, Inc., 37 Wall Street, New York 5, N. Y.

Ford Awards Coke Plant Contract to Koppers

Pittsburgh, Pa.—Ford Motor Co. has awarded Koppers Co., Inc., a contract for the design and construction of a battery of 37 chemical recovery coke ovens and additions to its coal chemicals plant, it was announced here by Joseph Becker, Vice President and General Manager of Koppers Engineering & Construction Div.

The 37 new Koppers-Becker ovens, gun flue type, will furnish metallurgical coke for making additional iron for new Ford foundry facilities. Ford is building a production foundry in Cleveland to serve its new engine plant there, a new specialty foundry at River Rouge, and is expanding its Dearborn iron foundry. The new cake battery will produce both blast furnace and foundry coke.

Expected to be placed in operation in early 1952, the new ovens will be equipped with double collecting mains similar to those on the three coke batteries, each consisting of 61

Continued on Page 62

No. 49
Product of
Cooper Oven Thermometer Co.
Pequabuck 2, Connecticut

Most modern stoves have automatic oven controls, but careful cooks want *more* than that. They know that a dependable heat indicator *inside* the oven . . . *where the cooking is done* . . . is the secret of calls for "seconds"! These easy-reading Cooper Oven Thermometers, actuated by Chace Thermostatic Bimetal, find favor with housewives *and* manufacturers.

The smaller thermometer is used by stove manufacturers as original equipment; its spring clip is quickly and easily welded to the oven rack in convenient, out-of-the-way locations. The larger portable type is sold to consumers. Each is actuated by a Chace Bimetal coil having one end fixed to the indicator shaft, the other to the back of the dial. The coil rotates as the bimetal responds to temperature changes, moving the pointer to the correct temperature value.

This rotating motion is but one of many responses obtained with Chace Thermostatic Bimetal. Others include bending, linear, or combinations of various motions. Perhaps *your* product can utilize the unique properties of this versatile and dependable material. Let the Chace Application Engineer help you determine your thermostatic bimetal requirements.

IT BENDS WITH THE HEAT

W. M. CHACE CO.
Thermostatic Bimetal
1619 BEARD AVE., DETROIT 9, MICH.

Koppers ovens, now in operation at the Ford plant. The additional ovens will increase the plant's coke producing capacity from 1,225,000 to 1,430,000 tons per year.

The coal chemical and benzol plants will be enlarged to accommodate the increased coal chemical production from the new battery of ovens.

Worthington-Gamon Meter Co. Made Division of Worthington Corporation

Worthington-Gamon Meter Co., Newark, N. J. formerly a subsidiary of Worthington Pump & Machinery Corp.—has been made a division of that corporation.

The new division will continue the manufacture of liquid meters at the former company's Newark plant, according to H. C. Ramsey, president of Worthington Pump & Machinery Corp., Harrison, New Jersey.

Robert R. Anderson, formerly president, Worthington-Gamon Meter Co., has been elected vice-president of Worthington Pump & Machinery Corp. and will act as general manager of the new division.

William C. Flanders, formerly vice-president of the meter company, has been appointed assistant general manager of the division and Walter H. Zeis, formerly secretary and treasurer of the meter company, has been elected assistant secretary of the Worthington corporation.

Robert R. Anderson, newly-elected vice-president of Worthington, joined the meter company in 1922. In 1932 he was elected treasurer; 1942 vice-president; and last year president of the Worthington-Gamon Meter Co. He is on the Board of Governors of the Newark Athletic Club, a member of the Downtown Club, Salaam Temple Shrine and the Montclair Elks. His home is in Glen Ridge, N. J.

William C. Flanders joined Gamon Meter Co. in 1925 as sales representative in New Jersey and was appointed sales manager in 1937 and vice-president in 1950. Mr. Flanders resides in Belleville, N. J., and is a member of the Newark Athletic Club and Kane Lodge, F. & A. M.

Walter H. Zeis started his career with the Worthington corporation in 1925 and served in various accounting capacities until his election as treasurer of the Worthington-Gamon Meter Co. in 1948. He was also elected secretary of the subsidiary company last year. Mr. Zeis makes his home in Brooklyn, N. Y.

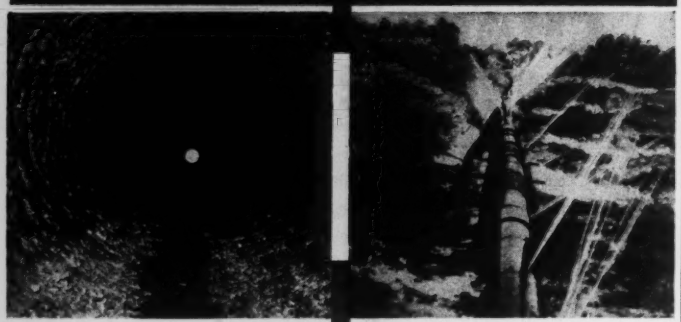
Westinghouse To Open Plastics Plant In South Carolina

The Westinghouse Electric Corporation will open a plant for the manufacture of Micarta at Hampton, South Carolina—the first divisional manufacturing plant to be established by the Company in the Southeastern United States—it was announced recently by O. O. Rae, Westinghouse Southeastern District Manager.

Scheduled to begin operation early in 1951, the new plant will manufacture primarily decorative materials for homes, offices and stores. The laminated plastic is also used for bearings, propeller shafts, helmet liners, and other applications. The parent Micarta manufacturing division is located at Trafford, Pa.

The building housing the new plant was leased from the Pleywoods-Plastic Corporation. It contains 40,000 feet of floor space and is equipped with various types of plastics-processing machinery.

Stop Pipeline Corrosion and Leakage with CENTRILINE



Corrosion and leakage are effectively controlled when pipelines are cleaned and cement lined by Centriline. Note these important features of Centrilining:

1. Work is done *mechanically*—1000' per day and more.
2. Cost is a *fraction* of that for new pipelines.
3. Pipeline remains *underground*—minimum disturbance to operations.
4. Temporary *by-pass service* provided where necessary.
5. EXPERIENCE—over 2,500,000 lineal ft., in cast iron, steel, & concrete pipe, in *4" to 144" diameters.*
6. Applicable to fresh or salt *water,* oil, sewage, gas and industrial *waste* lines.
7. Work complies with pertinent A.W.W.A. specifications.
8. ADVANTAGES: Permanently increases carrying capacity; Raises distribution pressures; Reduces pumping costs; Stops leakage at joints or where pitted; Lengthens pipe life; Saves water; Eliminates water discoloration; Reduces maintenance costs.

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American Pipe & Construction Company of Los Angeles, Calif. (P.O. Box 3428, Terminal Annex) Licensee Western Part of U. S.

• LATEST CATALOGS

Technical Report on Fluid Flow Rate Testing

A Technical Report originally prepared for company staff engineers is now being offered free of charge. This report contains comprehensive data on the newest technical developments on fluid flow rate testing for the aviation industry in particular. A complete discussion of engineering principles as well as detailed flow curves and charts is included. In addition, this bulletin describes the newest calibration techniques and illustrates modern precision-accuracy calibration panels. Copies of Technical Report A-9C-4 may be obtained by writing to Fischer & Porter Co., 3780 County Line Road, Hatboro, Pa.

New Allis-Chalmers Car Shaker Bulletin

Allis-Chalmers car shaker for unloading granular material from hopper-bottom gondola cars is described in a new bulletin released by the company.

Construction features of the shaker are given along with specifications and a cross

• Keep Informed . . .

section through the vibrating mechanism.

The shaker, designed to save time and money and to eliminate danger to operating personnel, has applications in power houses, steel mills, sand and gravel, chemical, coke and glass plants, coal mines and docks, sugar beet and paper mills, foundries, and building block and slag product manufacturing plants.

Copies of the bulletin, "Allis-Chalmers Car Shaker," 07B7221A, are available upon request from Allis-Chalmers Manufacturing Co., 949 S. 70th Street, Milwaukee, Wis.

New Richardson Bulletin

A new Proportioning, Blending and Process control equipment bulletin has just been issued by Richardson Scale Co., Clifton, N. J. The two-color bulletin, which contains 21 pictures of typical Richardson control panels and Automatic Scales, is devoted to descriptions and specifications of the various Richardson precision units. The scales described are of the "pre-weighing" type, which refers to the delivery of prescribed amounts of material, as opposed to the more familiar "post weighing" which means the determination of the weight of an unknown mass. The bulletin gives several examples of complete systems that have been installed, ranging from proportioning glass aggregate for furnaces to weighing meals for cookers in distilleries.

B&W "Descriptive Terms—Steel Tubing"

Babcock & Wilcox Tube Co. offers a new bulletin, "Descriptive Terms—Steel Tubing." This twenty-page, pocket-size booklet presents brief descriptions of terminology used in the manufacture and application of steel tubing. As the meaning of many of the terms used by the tubing industry is more specific than the ordinary definition of the term, the booklet will be of interest and value to anyone connected with the production of items using tubing. Known as Bulletin TB-335, it is available on request to The Babcock & Wilcox Tube Co., Beaver Falls, Pa.

The company, with plants at Beaver Falls and Alliance, Ohio, manufactures seamless and welded carbon, alloy and stainless steel tubing for all types of pressure and mechanical applications.

Booklet Describes New Westinghouse X-ray Thickness Gauge

A new eight-page booklet describing the x-ray thickness gauge is available from Westinghouse Electric Corp. This gauge is designed to provide a non-contact method of measuring cold-rolled steel strip thicknesses from 0.0050 to 0.1196 in. as it passes through cold mill operations—at the high speeds of the rolling mill, or at the speeds of the slower processing lines.

The booklet presents the basic theory of the gauge, block-diagramming its electrical circuits to explain its operation. The operator's control, the gauging unit, and the indicator unit are described fully. Complete electrical and mechanical specifications also are given.

For a copy of this booklet, DB 404-100, write Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.

Continued on Page 65

For the DEPENDABILITY You Seek

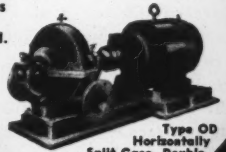
we recommend PUMPS "by Aurora"

Capacities to 4,000 G.P.M.

Heads to 300 Ft.

PUMPS "by Aurora"

For Every Purpose



Type OD Horizontally Split Case, Double Suction, Single Stage Centrifugal Pump

WRITE for BULLETIN 105

The Type OD PUMPS

— for general water supply for municipalities, industries, office buildings, institutions — also — for handling liquids, chemical solutions, oils, etc. in industry.

APCO TURBINE-TYPE PUMPS

— ideal for "1001" duties where small capacities and high heads predominate. Get acquainted.

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INSULATED PIPING . . .

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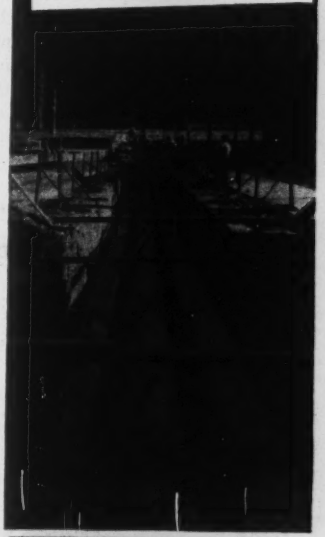
When you have an insulated piping problem, remember that only the best will give you ALL the advantages necessary to full-efficiency performance of your system. That means Ric-wiL Prefabricated Insulated Piping.

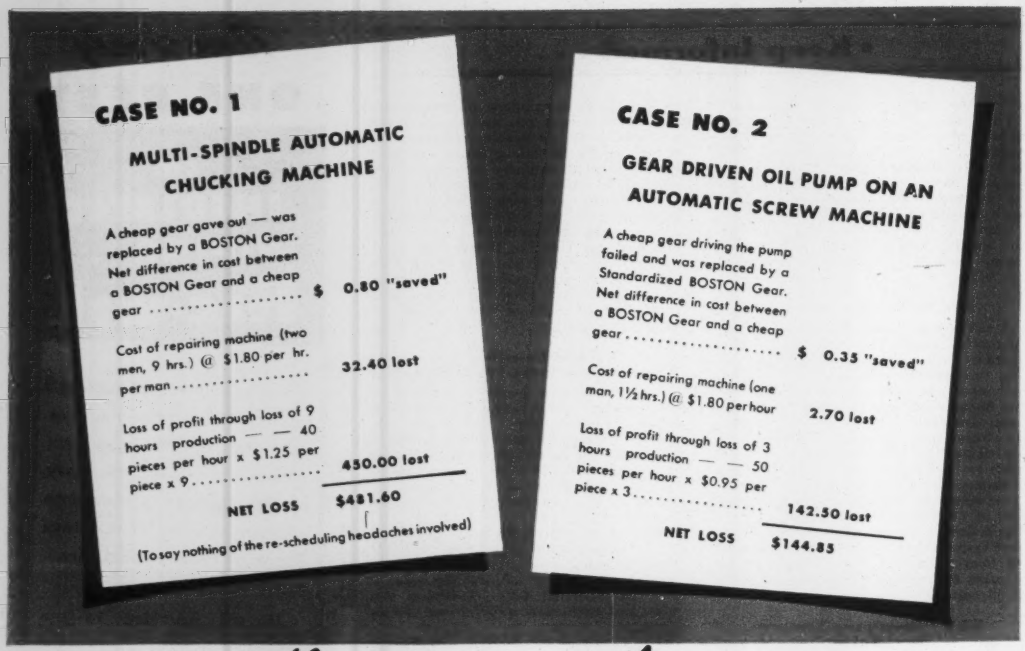
Ric-wiL provides (1) top-efficiency system engineering, (2) fast, economical installation, (3) the right protection and insulation for the job.



Ric-wiL PREFABRICATED INSULATED PIPING

UNDERGROUND OR OVERHEAD

THE RIC-WIL COMPANY · CLEVELAND, O.


CASE NO. 1
MULTI-SPINDLE AUTOMATIC CHUCKING MACHINE
A cheap gear gave out — was replaced by a BOSTON Gear. Net difference in cost between a BOSTON Gear and a cheap gear ..... $ 0.80 "saved"
Cost of repairing machine (two men, 9 hrs.) @ $1.80 per hr. per man ..... 32.40 lost
Loss of profit through loss of 9 hours production — — 40 pieces per hour x $1.25 per piece x 9 ..... 450.00 lost
NET LOSS $481.60
(To say nothing of the re-scheduling headaches involved)
CASE NO. 2
GEAR DRIVEN OIL PUMP ON AN AUTOMATIC SCREW MACHINE
A cheap gear driving the pump failed and was replaced by a Standardized BOSTON Gear. Net difference in cost between a BOSTON Gear and a cheap gear ..... $ 0.35 "saved"
Cost of repairing machine (one man, 1½ hrs.) @ $1.80 per hour 2.70 lost
Loss of profit through loss of 3 hours production — — 50 pieces per hour x $0.95 per piece x 3 ..... 142.50 lost
NET LOSS $144.85

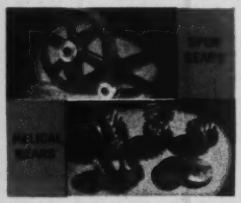
HOW *Cheap* IS A *Cheap* GEAR?

Sure, you can shop around and buy gears for a few cents less than STANDARDIZED *Boston Gears* — gears of known quality and proved performance.

But, stop and think what this "saving" really means. The purchase price of the gear is a tiny fraction of the cost of replacing a gear.

Look at these typical examples. They're not exaggerated. You can think of many like them.

Gears of inferior quality not only wear out faster, requiring more frequent replacement, but they're noisier, waste power, cause frequent bearing replacement... With gears it pays to standardize on the best — in design, material, workmanship, finish, accuracy — *BOSTON Gears.*

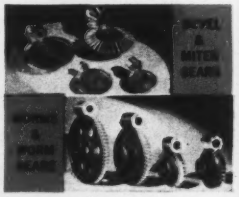


SPECIFY STANDARDIZED BOSTON GEARS

DESIGN THEM INTO YOUR EQUIPMENT

GET THEM FROM NEARBY STOCK

(*See list of Authorized Boston Gear Distributors*)



BOSTON GEAR WORKS

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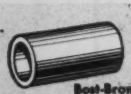
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171 Fremont St.

BOSTON Gear

STOCKS ARE Near

• Keep Informed . . .

Bulletin on Feed Water Control

The latest developments in Bailey Three-Element Feed Water Control are described in a new 16-page bulletin published by Bailey Meter Co., 1026 Ivanhoe Road, Cleveland, Ohio. The bulletin contains a straightforward, concise discussion of problems encountered in Feed Water Control and explains how the Bailey Air-Operated Three Element System helps solve them.

Diagrams, cutaway views, typical chart records and photographs of modern installations are used liberally to aid in describing the Control System.

Ask for Bulletin 105-C.

Power Factor Correction

Examples illustrating basic considerations in the improvement of system power factor are contained in a new leaflet released by Allis-Chalmers Manufacturing Co.

The leaflet points out that improving plant power factor results in many economic and operational advantages; that as a rule it is advisable to keep the load power factor up to 0.8 lagging or higher, and that the effects of low power factor can be easily and inexpensively corrected by the judicious use of synchronous motors or by the use of a synchronous condenser. Reasons why synchronous motors and condensers improve the power factor are graphically presented.

Copies of the leaflet, "Power Factor Correction Through Use of Synchronous Motors and Condensers," 05B7465, are available upon request from Allis-Chalmers Manufacturing Co., 949 S. 70th Street, Milwaukee, Wisconsin.

G. E. Offers Bulletin on High-Speed Synchronous Generators

A new four-page, two-color bulletin on Tri-Clad* high-speed synchronous generators has been announced as available from the General Electric Company, Schenectady 5, N. Y.

Designated as GEA-5470, the publication covers generators for standby, portable, and prime-source power in ratings from 1.875 to 50 kva with frequencies of 50 and 400 cycles. Four designs are described in the bulletin: externally-regulated, self-regulated, and packaged-regulated 4-pole synchronous generators, and high-frequency 14-pole synchronous generators.

Well illustrated with product pictures as well as cut-away and exploded-view photographs, the publication enumerates construction features of the new generators and includes a comparison table of ratings.

*Reg. Trade-Mark of the General Electric Co.

Table on Tolerances for Round and Alloy Steel Mechanical Tubing

The Babcock & Wilcox Tube Co. announces the latest edition of a table on tolerances for round seamless carbon and alloy steel mechanical tubing, giving permissible variations in diameter and wall thickness. It refers to cold-drawn-unannealed and finished-annealed tubing in sizes to 8⅞ inches outside diameter, and to hot-finished tubing in sizes to 9⅝ inches outside diameter. This data card, 115C, is available on request to The Babcock & Wilcox Tube Co., Beaver Falls, Pa.

In addition to the seamless carbon and alloy steel mechanical tubing mentioned above, the company, with plants at Beaver Falls, Pa., and Alliance, Ohio, manufactures seamless and welded carbon, alloy and stainless steel tubing for all types of pressure as well as mechanical applications.

Worthington Announces New Bulletin on Precipitating Softener and Coagulator

A new Bulletin W-212-B6 describing the Type CM Precipitating Softener and Coagulator, in which energy for floc preparation is mechanical, is announced by Worthington Pump & Machinery Corp.

This supplements Bulletin W-212-B5, which describes the Worthington Hydraulically motivated system and the elementary chemical theory of softening. The new bulletin describes the flow circuit, diagrams the flow, and answers nine questions in a system appraisal.

Chemical feeders, dual purpose pump and chemical proportioning system are pictured and described.

Hinged Flat-Top Conveyor Chain Covered by New Link-Belt Folder

S-815 Flat-Top Conveyor Chain is the subject of a new 4-page illustrated Folder No. 2344 published by Link-Belt Co., giving dimensions and pertinent data on this light, durable, efficient type of conveyor chain and its cut tooth sprocket wheels—for the transportation of small containers, bottles, packages or parts through such operations as washing, bottling, packing, capping and labeling.

Each pitch of chain consists of only a hinge type bevel-edged flat top link and a pin to hinge adjacent links to each other with an "over-lap," assuring a continuous, smooth carrying surface and smooth transfers. The chain can be detached at any convenient pitch. No coupler links are needed.

Lack of continuous gap between top plates serves to eliminate any danger of tipping or stalling containers, since the chain will slide freely under them. The utmost cleanliness of handling is assured, as there are no pockets in which foreign matter might accumulate.

Copy of new Folder No. 2344 will be sent to any interested reader upon request.

Hyster's New Straddle Truck

Featured in a new Straddle Truck catalog just issued by the Hyster Co. of Portland, Oregon, is the Model "MHS", especially designed for handling steel.

A variation of the standard 30,000-pounds capacity Model "MH" Straddle Truck, the new model is intended for extreme service encountered in materials handling in the metal industry, or other operations where service is unusually severe.

Principal among a number of improvements and optional advances for extended utility are double-row roller chains in the hoist mechanism instead of single-row chain as in conventional trucks; solid bar rather than channel sections in the lifting links; additional carrying capacity of the suspension springs, and heavier frame in the cross members and corner sections.

The double-row roller chain provides stronger linkage between the hoist chain and the load-carrying shoes. The lifting links are threaded into socket members at their upper ends to provide a shoe adjustment on which the threaded sections cannot be damaged by action of the shoes proper.

The advanced shoe swing mechanism provides a more rigid locking device for maintaining the shoe in load-bearing position.

Although capacity of the steel handling truck is rated the same as the standard Hyster "MH3", the suspension springs have added carrying capacity to accommodate consistent handling of capacity loads.

Continued on Page 68

TIPS ON TAPPING AND THREADING TROUBLES

DATA

Page A-6

- OILS FOR TAPPING AND THREADING

Oils With Active Sulphur Required

Tapping and threading are difficult machining operations due primarily to limited chip room and the difficulty of maintaining sufficient lubrication at points of contact between threading tool and workpiece. Cutting oils having high sulphur activity are usually required and recommended for difficult threading and tapping work. Stuart's THREDKUT and related products, due to their high effective sulphur content, have been outstanding for this class of work. Active or effective sulphur in an oil functions as an anti-weld agent preventing pick-up of metal particles on the tool which results in scuffing and poor finishes.

- **Rule of Thumb**

Here is a good rule of thumb to remember when sulphurized cutting oils are being used:

When you observe excessive wear on the front clearance of cutting tools, DECREASE the amount of active sulphur in the oil by diluting with paraffin oil or other low cost blending oil. If poor finish is encountered due to welding or metal pick-up on the tool edge, INCREASE the active sulphur, or if Stuart's THREDKUT is being used, apply it straight.

RESULTS

Operation: Threading male pipe union sections on large automatics using single point tools.

Material: Type 310 stainless steel.

Oil:	Previous Oil	Stuart's THREDKUT 9961
Tool Life:	136 pcs. per tool grind	310 pcs. per tool grind
Part Finish:	Fair	Excellent
Cutting Fluid Costs on Machine:	$0.47 per gal.	$0.44 per gal.

Write for Literature and ask to have a Stuart Representative call

D. A. Stuart Oil CO.

2741 S. Troy St., Chicago 23, Ill.

• Keep Informed

The heavier frame is designed to withstand shock produced by the non-resilient packaging of steel billets and bars, which are handled on bolsters.

Optional guards protect tires when extremely high temperature material must be handled. Also optional is hydraulic steering, available with either the MHS3 or conventional MH3, which provides for minimum effort on the part of the operator in maneuvering the vehicle in close limits as well as on the highway, city streets or in other traffic conditions.

New Allis-Chalmers Water Conditioning Department Information Bulletin

The manner in which Allis-Chalmers No. 160 series corrosion inhibitor acts by neutralization and by surface adsorption to control the corrosion of steam and condensate lines is described in a new leaflet released by the company.

The corrosion inhibitor is a mixture of the most effective organic amines selected according to volatility characteristics required by each steam condensate system. It is a colorless liquid with a slight odor and contains no ammonia.

Use of the inhibitor is recommended where economic considerations do not justify expenditures for deionizers or sodium-hydrogen zeolite softeners.

Copies of the leaflet "No. 160 Series—Corrosion Inhibitor," 25X7582, are available upon request from Allis-Chalmers Manufacturing Co., 949 S. 70th Street, Milwaukee, Wisconsin.

New Banbury Mixer Bulletin Published by Farrel-Birmingham

A new bulletin on Banbury Mixers, No. 189, has recently been published by Farrel-Birmingham Co., Inc., Ansonia, Conn., to provide up-to-date information about recent improvements in design and construction, new applications and new installation layouts.

This new 32-page booklet contains general descriptive matter and illustrations of all sizes of Banbury Mixers, including a table of sizes and capacities, cross-section and cutaway views showing details of construction, and layout drawings showing various methods of installation in combination with other machines. Also described and illustrated are the new Uni-Drive Banbury Mixers, which have been especially developed to take the heavier loads resulting from mixing tougher stocks at higher speeds.

Copies of Bulletin No. 189 will be sent without charge upon request to the company's office at Ansonia, Conn.

Contour Projector Described in New Booklet

What the Kodak Contour Projector Model 2 is—and how it can be used to magnify dimensions, shapes, and surfaces in production or tool making—is the subject of a new descriptive booklet now being offered by the Eastman Kodak Company.

Pointing out that the projector is a potent weapon against rising inspection costs, the booklet describes both the features and application of the machine.

In announcing the availability of the booklet Wayne Norton, Manager of Kodak's Industrial Optical Sales Division, said, "Since increased production demands once again necessitate high speed, low cost, and yet still highly accurate inspection and quality control techniques, this booklet has

ESL BIBLIOGRAPHIES

No. 1. Filing Systems for Engineering Offices. 41 references. 1948. $2.00.

No. 2. Prestressed Reinforced Concrete. 190 references. 1948. $4.00.

No. 3. Precision Investment Casting by the Lost Wax Process. 111 references. 1949. $2.50.

No. 4. Pallets Used in Modern Materials Handling. 114 references. 1949. $2.00.

No. 5. Machinery Foundations; Design, Construction, Vibration Elimination. 120 references. 1950. $2.00.

No. 6. Non-Metallic Bearings. 101 references. 1950. $2.00.

No. 7. Domestic and Industrial Applications of Solar Heating. 149 references. 1950. $2.00.

No. 8. Management of Construction Jobs. 53 refences. 1950. $2.00

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Engineering Societies Library

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• Keep Informed . . .

been prepared to provide people, who are unaware of the Contour Projector's potentialities, with information on what the machine can do and why it can do it better, faster, and less expensively than any other quality control or inspection method."

Some of the special jobs that the projector can do as a matter of routine include, as shown in the booklet, looking into deep recesses, exploring and measuring sizable concavities in one continuous operation at high magnification, and checking intricate dimensional relationships. The projector also greatly simplifies the staging of parts.

Specifications, optics, and accessories for the Kodak Contour Projector Model 2 are described in considerable detail. The booklet has eight pages, liberal illustrations, and is $8\frac{1}{2}$ by 11 inches in size.

A copy of the booklet will be sent on request to Industrial Optical Sales Division, Eastman Kodak Company, Rochester 4, N. Y.

Nooter Corp. Releases 16-Page Catalog

"Beyond Your Blueprints" is the title of the 16-page catalog released by the Nooter Corp. of St. Louis, Missouri. Fully illustrated, the catalog provides many useful facts regarding steel and alloy plate fabrication—in addition to explaining and picturing the many specialized techniques and services of the Nooter Corp. in the fabrication of tanks and vessels for the petroleum and chemical processing industries.

Another exclusive and useful feature of the "Beyond Your Blueprints" Catalog is the extensive section devoted to valuable "Corrosion Data Charts"—in which are listed the resistance values of commonly used metals with reference to hundreds of chemicals.

Copy of "Beyond Your Blueprints" may be obtained without obligation. Address your request on company letterhead to Nooter Corp., 1400 S. 2nd St., St. Louis 4, Mo.

Barco Publishes New Bulletin on Flexible Ball Joints

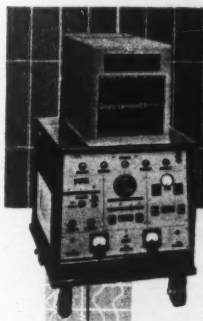
"Flexible Ball Joints" is the title of a new 16-page bulletin which has just been published by Barco Manufacturing Co., well-known Chicago maker of flexible ball, swing, swivel, revolving, and other types of movable joints for use in piping for power, process, heating, chemical, or hydraulic service.

The Barco ball joint is one of the most versatile fittings ever developed to provide flexibility in piping. Basically, it consists of a short pipe nipple terminating in an enlarged hemispherical section or ball which is housed inside an outer casing between two molded gaskets. This construction permits rotation as well as side flexing of the ball part in any direction up to 40°.

The joints are commonly used to overcome piping misalignment, to allow for settling or movement of piping, to guard against vibration or shock, to permit movement of loading or unloading lines, and for many other applications.

To meet the needs of industry for this type of fitting, Barco manufactures 12 styles of the joint and fifteen different sizes, from $\frac{1}{4}$" to 12", and offers a choice of seven different service specifications and six different metals for handling temperatures from −50° to 1000°F., pressures from vacuum to as high as 750 p.s.i. steam or 6,000 p.s.i. hydraulic, as

Continued on Page 68



NEW HIGHS IN RESOLUTION

The Hathaway SC-16A Six Element Recording Cathode-Ray Oscillograph, designed for recording fast transients and continuous phenomena, brings you new highs in resolution because of its unusually high frequency response and high chart speed. Note these unusual features:

FREQUENCY RESPONSE 0 to 200,000 cycles per second • RECORDS up to 1000 ft. long at speeds up to 600 inches per second • RECORDS up to 10 ft. long at speeds up to 6000 inches per second • WRITTING SPEED above 5,000,000 inches / second • SIX ELEMENTS with interchangeable lens stages for 1, 2, 3, or 6 traces on full width of chart • INTERCHANGEABLE RECORD MAGAZINES for continuous recording or short records of fast transients • PRECISION TIMING tuning fork controlled QUICK-CHANGE TRANSMISSION for 16 record speeds • AUTOMATIC INTENSITY CONTROL • CONTINUOUS SWEEP OSCILLATOR

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well as virtually all acid or alkali conditions.

The new bulletin is the most comprehensive ever published on the subject and contains complete specifications, dimensions, and application data for the entire line. It is believed that it will be of particular interest to design engineers as well as to operating engineers in plant and field installations. Copies of "Flexible Ball Joints" may be obtained by addressing requests to Barco Manufacturing Co., Department J-22, 1801 Winnemac Ave., Chicago 40, Illinois, for new Catalog No. 215.

New Booklet Describes Westinghouse Mill Motors and Control Equipment

A new 20-page booklet describing 600-Series mill motors and Class 9500 dc magnetic mill auxiliary controllers is available from Westinghouse Electric Corp.

The design features and construction details of the 600-Series mill motors are discussed, with sections devoted to armatures, bearings, field coils, brushholders, and ventilation. The booklet points out the high starting torque of these motors, simplified construction—meeting AISE specifications—for ease of servicing and maintenance, and complete utilization of space within the frame. It points out that they are built to meet the AISE specifications.

New Class 9500 dc magnetic controllers for mill auxiliaries are discussed in the second section of this booklet. These controllers use the newly-developed type M contactor, which is available in NEMA ratings from 25 to 2,500 amperes. The different controllers in the line are listed, with a typical circuit diagram presented and explained. Operation of the type AP plugging relays is explained. These voltage-sensitive relays are connected so that they can be adjusted accurately over a wide range to control the plugging operation.

Standard accessories for the controllers are described.

For a copy of this booklet, B-4730, write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

Carbide Tools and Parts

What is probably the most complete and useful catalog (No. GT-250) of carbide tools and parts ever published has just been released by Carboloy Co., Inc., Box 237—Roosevelt Park Annex, Detroit.

Not only does the 60-page catalog cover all data in former Carboloy tool catalogs and their various supplements, but many items not previously carried in stock have been added.

The catalog takes the informative "manual" type of approach—it not only lists tools, etc., but tells how to select and apply them. For instance, the extensive (over 30 pages) standard tool and blank sections include information as to most suitable uses of each type plus an illustrated example or two. Standard blanks now also include many new sizes for "clamped-on" style tools.

The differences, and even the limitations, in the various grades of carbide are clarified—not only for tool grades but also for the wear-resistant grades. This makes it easy for the user to select the correct grade for practically any application of carbides in the tool or non-tool field, particularly since technical design and application data usually found only in manuals is part of the catalog.

Striking in the catalog is the evidence of rapid development of non-tool uses for carbide. Many such applications have now become so much in demand that the appropriate carbide parts are now regular catalog items. Included for instance are: tubing and other special shaped lengths in various sizes; more sizes of rectangular strips; solid guide bushings as used in the wire and other industries; seven sizes of carbide check valve seats; slotted guide rings for the textile and wire industry (eliminate threading of the ring); expanded lines of gage blanks; etc.

Four-color illustrations are used profusely. To make the catalog easy to use it is divided into sections with a pictorial index. Helpful technical literature offered by Carboloy Company is also listed and described.

This catalog would seem to be one book every shop man, P. A. and design engineer should have.

G. E. Announces New X-Ray Photometer Bulletin

A new eight-page, two-color bulletin on the x-ray photometer for chemical analyses by x-ray absorption has been announced as available from the General Electric Company, Schenectady 5, N. Y.

Designated as publication GEC-412A, it lists some of the applications for the instrument in the petroleum and chemical industries. Profusely illustrated, the bulletin explains the theory of operation, principal components, and operating procedure of the G. E. x-ray photometer.

Also included in the bulletin are complete specifications of the new measurement aid along with procedure information for obtaining analyses on the x-ray photometer by submitting samples to General Electric Company's Laboratories.

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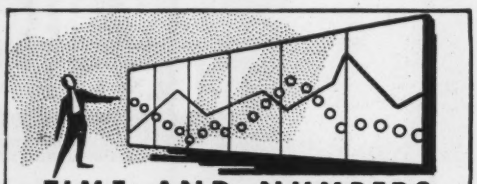

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Do you need a permanent record of specific times and numbers that apply to your laboratory or production work? Streeter-Amet has the instrument which will accurately and speedily record either numbers or time or both at the same time on paper tape for easy readability.

The counter operates by any means capable of supplying a switch closure or an electrical impulse. Counts may be indexed by time or number printed alongside the count.

For high speed counting of a predetermined number of completed articles, the Streeter-Amet Predetermined Counter automatically counts and then shuts off or controls associated machinery when the predetermined number is reached. An outstanding timesaver when packing a given number of small articles in a carton or bottle and measuring lengths of wire or sheets in a bundle.

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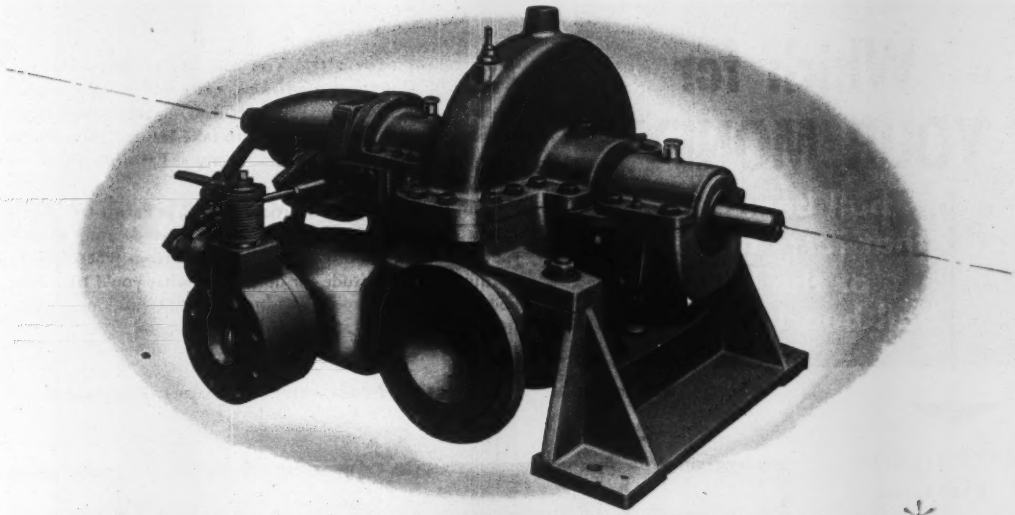
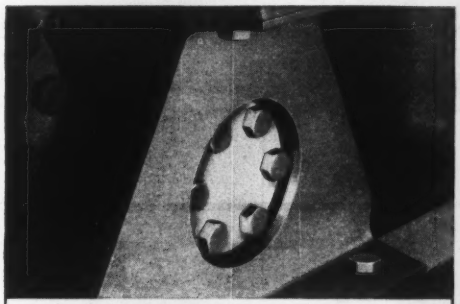


Alignment that *STAYS TRUE** when the heat's on!



Three-Way Centerline Support

* The Type E method of support allows three-way freedom of expansion and contraction without disturbing the alignment of the rotor shaft. The governor end is mounted on a strong but flexible channel beam to permit axial expansion. At the shaft-coupling end, a unique keyed support connects to the turbine near the shaft centerline to permit lateral expansion; and a vertical kingpin transmits thrust from the expanding steam pipes directly to the foundation and not to the turbine. The casing is free to move vertically with expansion or contraction.

Heat expansion can't disturb Type E alignment. The operation of driven equipment is easier, more dependable —installation costs are reduced. Westinghouse unique *three-way centerline support* keeps alignment perfect with the driven machine. Strong supports at both the governor and exhaust ends are supplemented by a vertical kingpin that transmits lateral thrust to the foundation. Hot or cold —for constant operation or instant stand-by power, you can depend on the Type E Turbine to "Stay True"!

There are other cost saving advantages, too. Dual protection against overspeed, weatherproof bearing seals, corrosion-resisting gland zones, floating movement of governing and trip linkage, and parts interchangeability between wheel sizes are just a few.

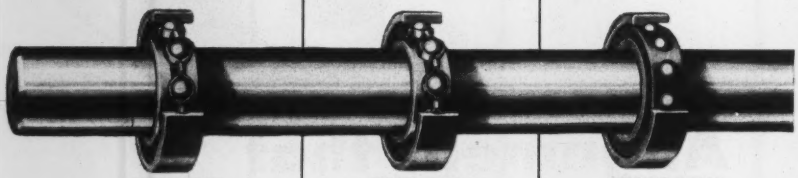
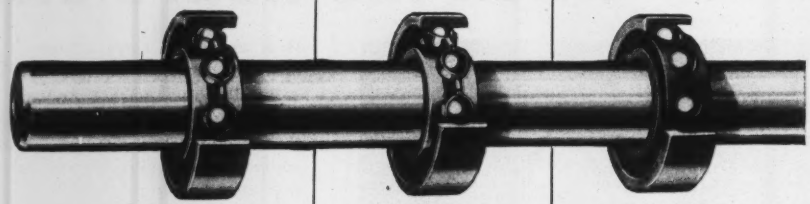
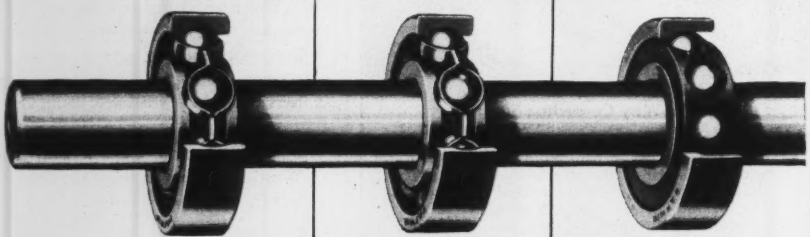
For the full story ask your nearby Westinghouse Steam Specialist for the Type E Turbine Book B-3896, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50520

YOU CAN BE SURE... IF IT'S
Westinghouse
TYPE E Turbines

ball bearings that just "get by" or the best ball bearing "buy"

THIS CHART PROVES IT! You can specify the shaft size, speed, load, service conditions, space and weight limitations . . . and get the Fafnir Ball Bearing that meets those specifications exactly. No need to take less ball bearing or more than just what you need . . . because Fafnir makes them all . . . for all industries.

You get something else, too, that makes Fafnir Ball Bearings a particularly good buy. It's an attitude and an aptitude, a way of looking at ball bearings from where you're sitting and an aptitude for doing just what you'd like done about it, gained from working with not just one or two industries but with all industries.

	Standard	Special Precision	Super Precision
EXTRA-LIGHT **9100 Series** Compact, space-saving, large bore, light cross section design.	 9100 SERIES	M9100 SERIES	MM9100 SERIES
LIGHT **200 Series** for loads relatively light in proportion to shaft capacity.	 200 SERIES	M200 SERIES	MM200 SERIES
MEDIUM **300 Series** for medium or average loads and continuous operation.	 300 SERIES	M300 SERIES	MM300 SERIES

Fafnir Radial Ball Bearings are available in standard shaft sizes in single and double row designs, in duplex arrangements of matched pairs (tandem, back-to-back and face-to-face), and with various arrangements of seals and shields. Fafnir also makes a complete line of ball and roller bearing power transmission units. Write for catalog. The Fafnir Bearing Company, New Britain, Conn.

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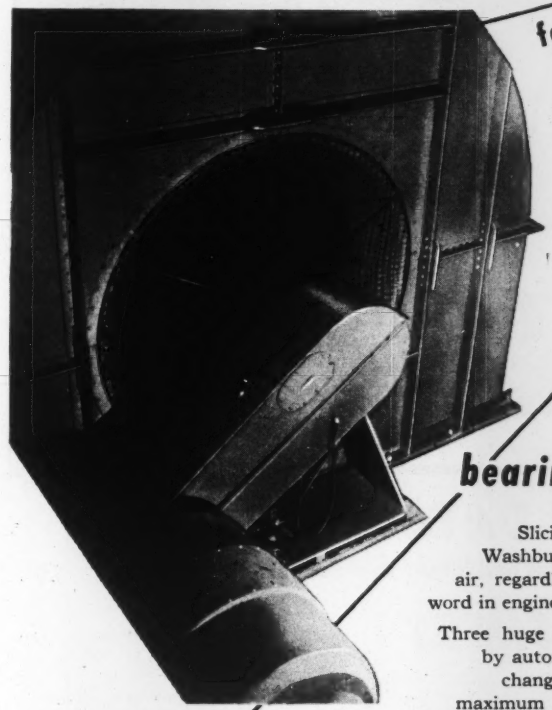
for Houston's Washburn Tunnel



. . . thanks to Westinghouse Sturtevant fans

bearings by SKF

Slicing under the Ship Canal, Houston's Washburn Tunnel is guaranteed abundant fresh air, regardless of heavy traffic, thanks to the last word in engineered ventilation.

Three huge Westinghouse-Sturtevant Fans, regulated by automatic electronic controls, supply a complete change of air every two minutes. They have a maximum capacity of 760,000 CFM . . . and friction, need for lubrication and inspection are held to the minimum by SKF Spherical Roller Bearings. It is because of a well-earned reputation for dependability, because of their self-aligning properties and their ability to deliver continuous trouble-free service under adverse conditions that SKF Bearings have been specified for most of the country's major tunnel-fan installations.

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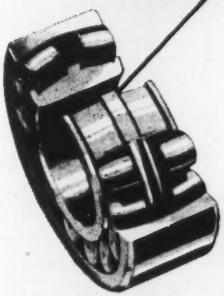

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ON THIS SIDE – Data on the WeldELL line

ON THIS SIDE

– Data on Taylor Forged Steel Flanges

A VOLUME OF DATA

. . . covering welding fittings and forged steel flanges . . .

ON A SINGLE SHEET

Here is just about the handiest tool ever devised for the pipe designer. Data on welding fittings and flanges that otherwise could be found only by plowing through many catalog pages and tables have been ingeniously condensed on the two sides of the durable letter-size card illustrated above.

One side covers the broad WeldELL line of Taylor Forge welding fittings. For every nominal pipe size, ½" through 30", it shows the wall thickness for every weight of every fitting in every available material. It also shows all required dimensions of all types of fittings.

The other side covers the world's most complete line of forged steel flanges. For every nominal pipe size, ½" through 24", it gives all essential dimensional and bolting data for all types of flanges in all weights. A particularly useful table (see reproduction) is that showing welding neck flange bores which enables you to determine the I.D. of any nominal pipe size without separate calculation. Thus the sheet gives you O.D. and I.D. of any weight of pipe.

The card is varnished to make it stand the steady usage you are certain to give it. To obtain your copy see your Taylor Forge distributor or **MAIL THE COUPON.**

TF

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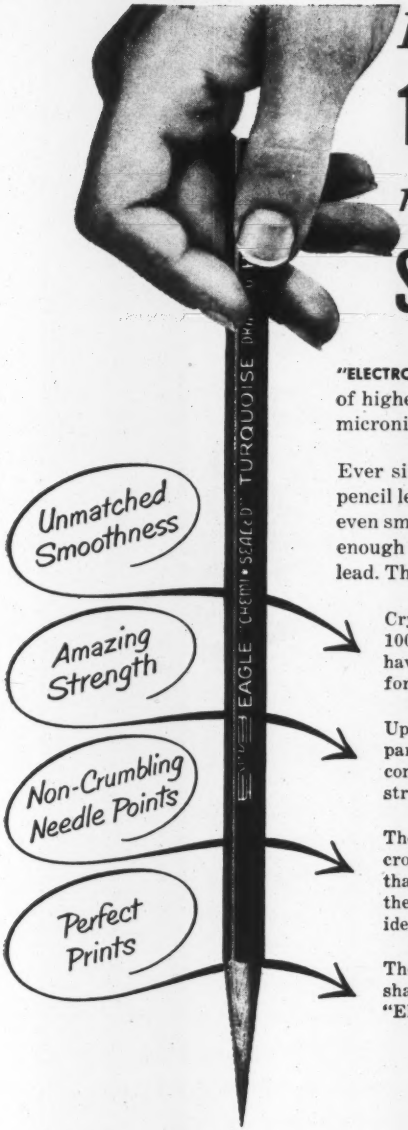


Here's why

100% "Electronic" Graphite

makes the new Turquoise

Serve You Still Better

"ELECTRONIC" is Eagle's trade name for a blend of crystalline graphites of highest purity from Madagascar and Ceylon, reduced to particles of micronic fineness in our patented Attrition Mill.

Ever since we tested our first pound of "Electronic" graphite in fine pencil leads and found how much they were improved by the addition of even small amounts, we have planned for the day when we could process enough of this super-graphite to use it 100% in every TURQUOISE lead. That day has come! Here's what it means on your drafting board:

Crystalline graphite is nature's perfect lubricant. Leads made with it 100% have a frictionless, smooth-gliding quality impossible in leads having the usual content of amorphous graphite which contains harsh foreign materials.

Upon reduction, the graphite crystals break down into microscopic particles of infinitely varied, close-interlocking shapes. The clay binder completes an extremely dense ceramic structure . . . the strongest lead structure ever achieved.

The particles of "Electronic" graphite are so fine that millions more crowd into the air spaces in the lead, producing a richer, tighter lead that deposits more particles, more evenly, at every stroke. That's why the new TURQUOISE lead holds a needle point better than ever and is ideal for long, even lines.

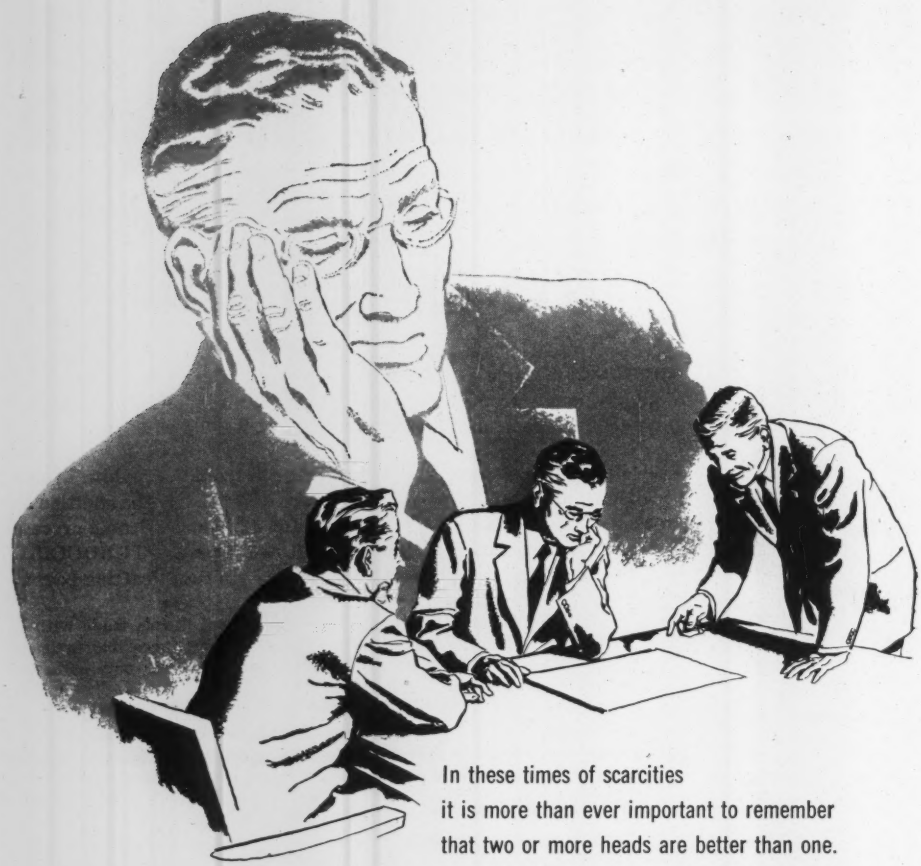
The finer the particles of crystalline graphite, the blacker, denser and sharper is the line deposited on the paper. Drawings made with 100% "Electronic" graphite reproduce to perfection.

PROVE IT YOURSELF
Order TURQUOISE today from your dealer. Or write us for a sample in any degree you desire.

EAGLE PENCIL COMPANY
NEW YORK • LONDON • TORONTO

EAGLE
TURQUOISE

WITH 100% *"ELECTRONIC" GRAPHITE



In these times of scarcities
it is more than ever important to remember
that two or more heads are better than one.
Your suppliers, for example, know a great deal
about their materials, how to select, specify and fabricate them.
No matter what you buy, it will pay you
to draw upon this knowledge.
It may be able to make scarce materials go further,
reduce costs, perhaps even speed up production.
AND of course for close and confidential collaboration
on copper and its alloys, and aluminum alloys,
CONSULT REVERE!

REVERE 150th YEAR OF SERVICE TO AMERICA

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

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Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere

SEE "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

More time for creative drafting!

Look at just two of the ways Kodagraph Autopositive Paper saves valuable drafting time for the Cleveland Crane and Engineering Company.

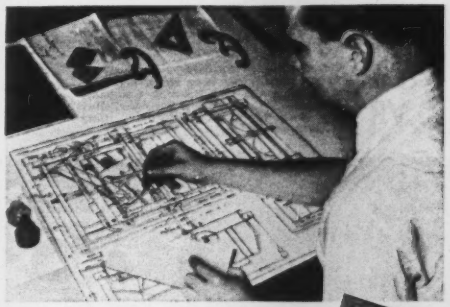
The chances are you'll be able to take similar short-cuts in your work . . . *turn hours of costly retracing time into hours of creative drafting time.*

1 Time saved . . . when drawings must be combined

Many clients order custom jobs requiring electrical components which Cleveland Crane must obtain from outside vendors. Oftentimes, the designs for several of these units must be combined in one drawing before original drafting can begin. This used to be a tedious retracing job—*but no longer.* Now, desired sections of the vendors' prints are reproduced as a composite print on "Autopositive" Paper. Exposure is in a direct-process machine; processing is in standard photographic solutions. The result is a sparkling positive intermediate . . . with dense photographic black lines on a clean, evenly translucent base. On it, the draftsman simply adds the necessary wiring detail . . . producing a new "master" in a fraction of the old time.

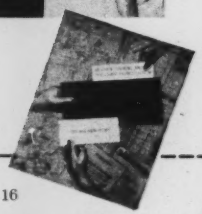
2 Time saved . . . when drawings must be changed

New design must replace old detail on complicated switch assembly drawings. *And Cleveland Crane is doing the job the easy way:* instead of making a new drawing—which would be 85% retracing—they reproduce the original one on Kodagraph Autopositive Paper. Then the draftsman removes the unwanted lines from the intermediate print with corrector fluid . . . and draws in the new detail. Result: a brand-new "original" is ready in three hours instead of 3 days. *Ready* to produce sharp, legible shop prints in the desired number.



Kodagraph Autopositive Paper

"The Big New Plus" in engineering drawing reproduction



- **It enables you, or your blueprinter, to produce positive photographic intermediates directly at a new, low cost.**
- **It enables you to reclaim old, weak-lined drawings . . . reproduce opaque originals and prints.**
- **It protects your valuable originals . . . produces more legible shop prints.**

—MAIL COUPON FOR FREE BOOKLET—

EASTMAN KODAK COMPANY
Industrial Photographic Division, Rochester 4, N. Y.

Gentlemen: Please send me a copy of your illustrated booklet giving all the facts on Kodagraph Autopositive Paper.

Name_____ Position_____

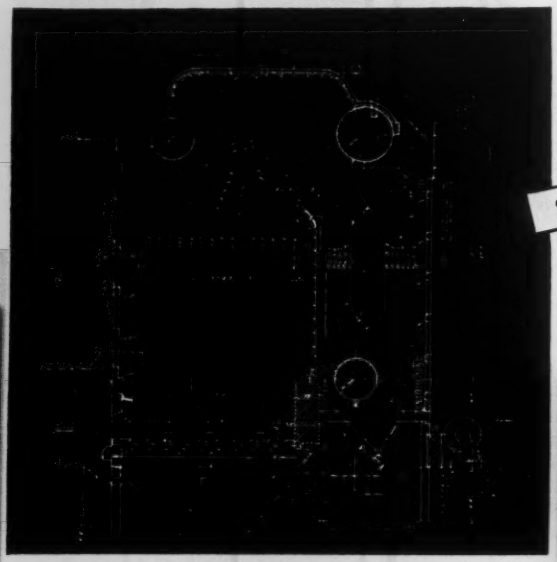
Company_____ Street_____

City_____ State_____

16

Kodak
TRADE-MARK

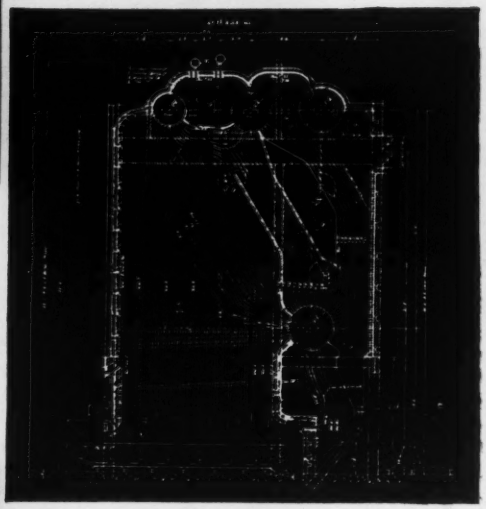
Quick Steaming at all Ratings!



Carry high overloads with high efficiency

SPECIFY **Vogt**

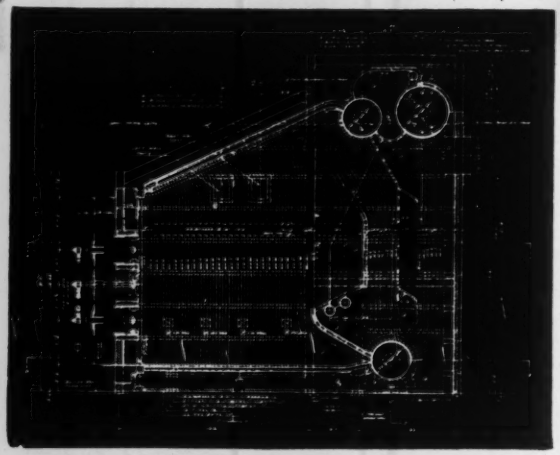
STEAM GENERATING UNITS



CLASS VL Two 27,500 pounds per hour units, installed at Brown-Forman Distillers Corporation, Louisville, Ky. Features large furnace volume in limited space, with high ratio of radiant heating surface.

CLASS LE Mt. Carmel Public Utility, Mt. Carmel, Illinois, is served by this 60,000 pounds per hour unit. Generous steam liberating surfaces and steam space permit wide fluctuations in load.

CLASS VR 70,000 pounds per hour steam generator at Humble Oil and Refining Company, Johnsue, Texas. An efficient, high-duty unit with water cooled furnace, using refinery gas fuel.



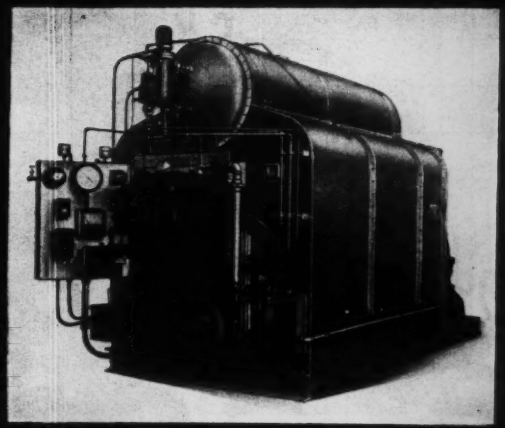
Vogt builds a complete line of bent tube steam generators, designed to burn solid, liquid, or gaseous fuels to meet specific operating conditions. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Bulletins with general information and showing typical installations are available upon request.

HENRY VOGT MACHINE CO.
LOUISVILLE 10, KENTUCKY

BRANCH OFFICES:
NEW YORK, PHILADELPHIA, CLEVELAND
CHICAGO, ST. LOUIS, DALLAS

Here's What You Get...

for your [illegible] *dollar*



Compact Design—The Keystone packs large steam capacity in small cubage, because of its unique furnace, contained within a low-head 2-drum water tube boiler.

Conservatively Rated—The Keystone offers unusually large heating surface per developed horsepower. Ratings are based on 5 square feet per developed horsepower—accepted practice in water tube boiler design.

Fast Steamer—The Keystone is highly responsive to changing load demands, for hot gases travel 3 lengths of the furnace, contacting 5 bare metal heat absorbing zones. Big boiler performance in small space.

Centralized Control—All specified instruments and controls, factory assembled, and mounted on a central instrument panel. All electrical connections to terminal blocks eliminate inter-connecting field wiring.

Automatic Burner—The Keystone is equipped with fully automatic burner for gas, oil or for both interchangeably.

Insulated Steel Casing accurately fitted to reduce radiation losses and air infiltration—removable panel type—all tubes accessible.

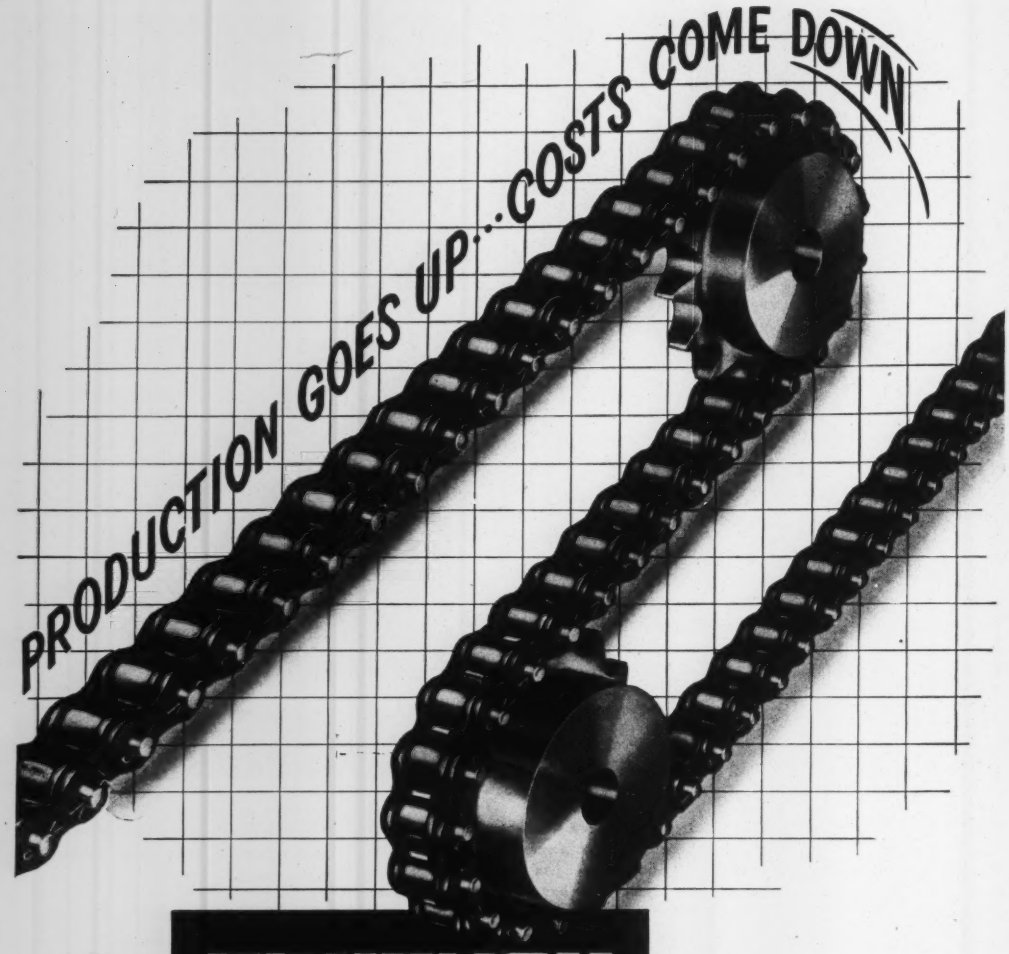
Combustion Control—interlocked electrical controls, steam pressure actuated for smooth adjustment of fuel, primary and secondary air supply to obtain most efficient high and low flame position.

Induced Draft equipment is of low speed, conoidal type with automatic damper control on panel.

Safety Controls include automatic cut-offs for high pressure, low water, flame failure, induced draft failure and fire switch.

Easy to install—easy to maintain—Keystone requires no special foundation or stack—just set in place and hook up service connections. Wind box is hinged for easy furnace inspection, hinged burner swings out for inspection—removable side panels give access to any tubes—manholes provide access to drums and tubes.

ERIE CITY IRON WORKS *1423 East Ave.* **ERIE, PA.**



with- **WHITNEY**
CHAIN DRIVES

Service records prove the unusual ability of Whitney Chain Drives to deliver full rated horsepower day in, day out, without failure. To you, as a designer or user of equipment, this means time and dollars saved. Production goes up *and stays up*, while *costs come down.*

HERE'S WHY — the rolling contact of finely finished, alloy steel chain, meshing into accurate, cut tooth sprockets eliminate power loss because there is no slippage or friction loss. They deliver constant power smoothly and efficiently.

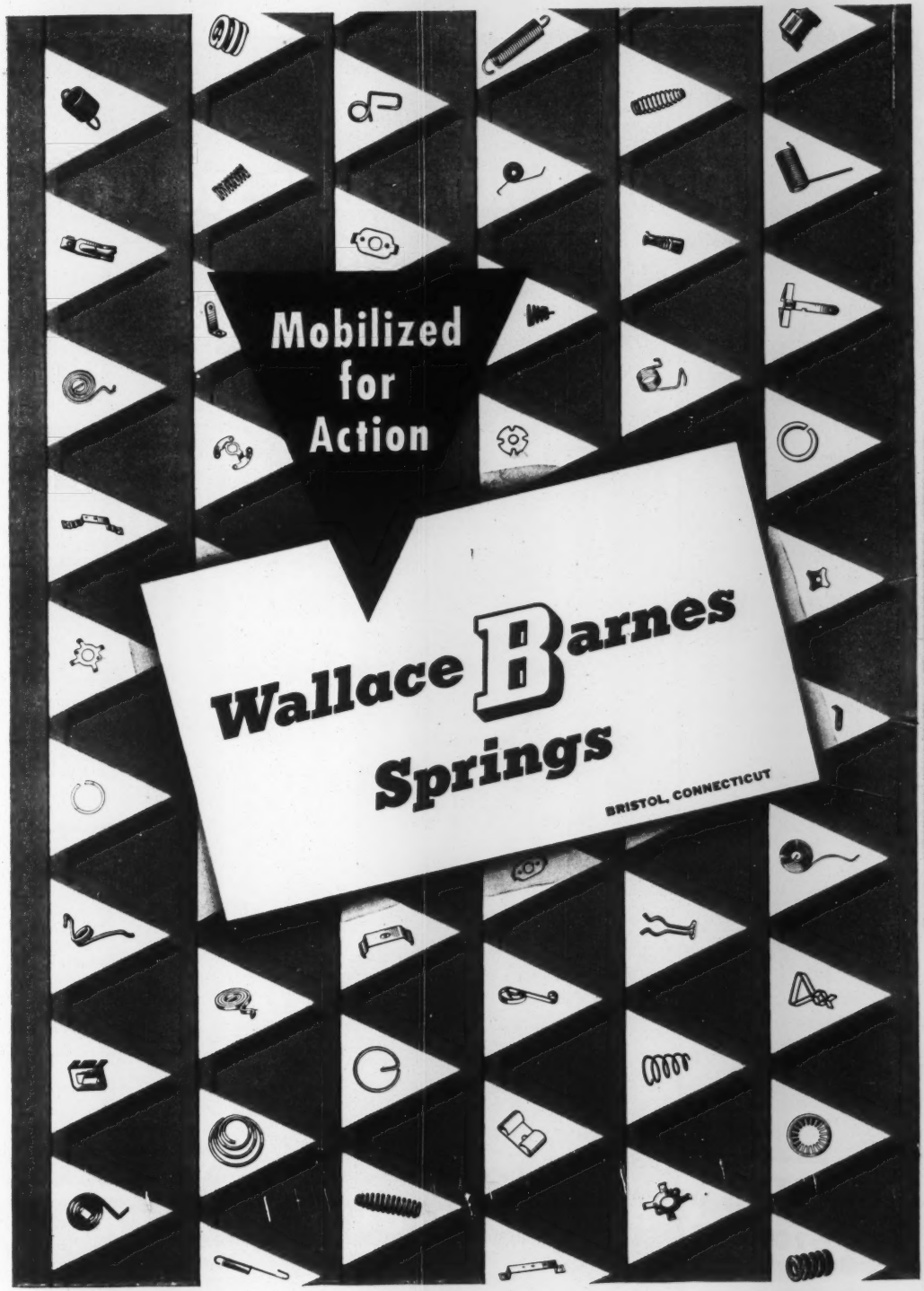
In addition, they absorb shock loads without breakage. And Whitney's alloy steel construction assures exceptionally long operating life . . . a vital point in keeping maintenance costs down.

But that's not all . . . Whitney Chain Drives simplify design problems. They can be operated on long or short centers without tension or excess bearing loads . . . drive shafts clockwise or counter-clockwise, simultaneously. They can be installed or taken off without dismantling shafts or bearings.

And Remember Whitney Service

In addition to the service facilities of more than 130 Whitney Distributors, Whitney maintains a network of 15 Field Engineering Offices, located throughout the country. The experience gained through more than 50 years of solving drive problems is at your service. From the complete line of Roller, Silent and Conveyor Chains, Whitney Engineers can recommend, without bias, the proper type of drive for your application...the chain drive which will give you the best service at lowest cost. Consult your nearest Whitney Field Office or write us direct for catalog and complete information.

WHITNEY CHAIN COMPANY
240 HAMILTON STREET, HARTFORD 2, CONN.


Mobilized
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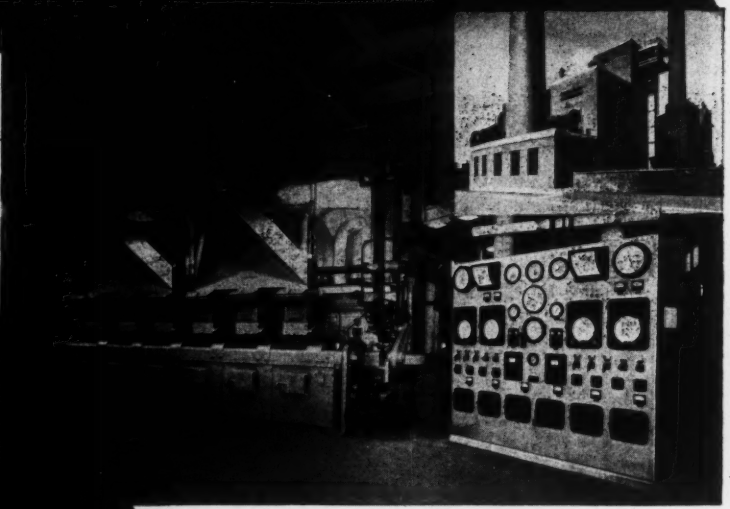
Wallace Barnes
Springs
BRISTOL, CONNECTICUT

See

DETROIT ROTOGRATE STOKERS



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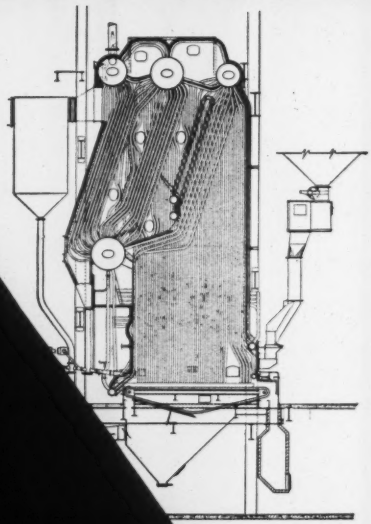


trial and Power Need

DETROIT SINCE 1898 STOKERS

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

District Offices in Principal Cities . . . Works at Monroe, Michigan

"Buffalo" Limit-Load Fan and Air Washer cleaning foundry air.

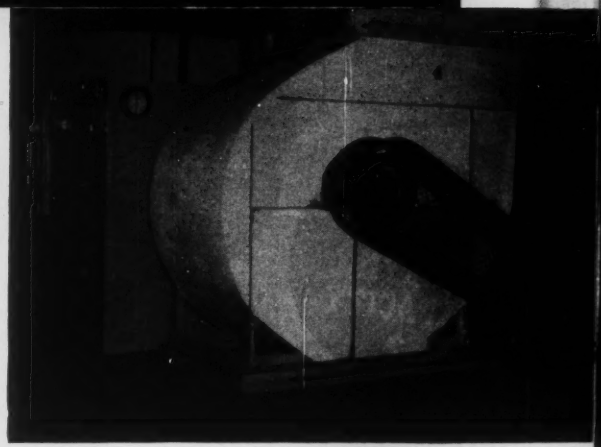
How You Can Put Your AIR TO BEST USE

"Buffalo" AIR CONDITIONING Can Do A *Complete* Processing Job

The industrial uses of air multiply daily! It's the recognized "comfort medium" that makes workers more efficient and productive. It's a "safety factor" which can minimize explosion dangers, fume poisoning and risk of "accident-prone" workers. *It can control your product quality, your turnout—and your profits—to a remarkable degree.* And present-day "Buffalo" Air Conditioning Units can create and maintain *any* air condition you require. You can wash your air, heat or cool it as desired, control the humidity exactly, collect dust by-products from your air—easily, continuously and economically—with "Buffalo" equipment.

"Buffalo FANS Often The Only "AIR CONDITIONING" You Need

Modern, efficient fans perform many of the functions of air conditioning. A "Buffalo" Limit-Load Fan, for instance, can "cool by ventilation"—circulating air continuously throughout the plant and causing a cool, comfortable feeling. "Buffalo" Fans can remove harmful dust, fumes and excessive moisture from your plant air. In these and dozens of other ways, "Buffalo" Fans can put your air to profitable use.



"Buffalo" "LL" Fan and Comfort Conditioning Cabinet supplying conditioned air in a large office building.

It Costs You Less Than You'd Think

"Buffalo" equipment is permanent equipment. Flimsy, light-weight "package" units are not part of our line. The results? Many "Buffalo" air washers are still giving efficient daily service over FORTY YEARS AFTER INSTALLATION. Many "Buffalo" Fans are OVER FIFTY YEARS OLD. Here, certainly, is long-run economy! Why not talk over YOUR air and its profit possibilities with a trained "Buffalo" engineer? Write us—we'll have him call on you AT NO OBLIGATION!

BUFFALO FORGE COMPANY

148 MORTIMER ST. BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in All Principal Cities

You get them all with Cone-Drive Double-Enveloping Gears—

LONGER LIFE ?

"HYDRAULIC" SMOOTHNESS ?

SMALLER GEARS ?

STRONGER GEARS ?

SIMPLER GEAR DESIGN ?

GREATER LOAD CARRYING CAPACITY ?

From the instant any two teeth of a Cone-Drive double-enveloping gear set come into engagement, they are engaged for their full depth and they stay that way—in full depth engagement—until they come out of engagement one-eighth of a revolution later.

To put it another way: ⅛ of all teeth in the gear of a Cone-Drive double-enveloping gear set are in continuous full depth engagement at all times.

This is possible because in Cone-Drive double-enveloping gears the teeth of the pinion are wrapped around the gear and the teeth of the gear are wrapped around (envelop) the pinion.(*)

This characteristic is what gives Cone-Drive Gears their high load capacity for a given size and weight, their quietness in operation, their "hydraulic" smoothness, their long trouble-free life.

(*) *Helical and spur gears are non-enveloping. Conventional worm gears are single-enveloping.*

CONE-DRIVE GEARS
DIVISION OF MICHIGAN TOOL CO.
7171 E. McNichols Rd.
Detroit 12, Mich.

Please send me without obligation further information on double-enveloping Cone-Drive Gears. We are particularly interested in the following:

Horsepower____to____

Ratio ____/1 to ____/1

Name_____

Title_____

Company_____

Address_____

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CONE-DRIVE GEARS
Division Michigan Tool Company
DOUBLE ENVELOPING GEAR SETS & SPEED REDUCERS
7171 E. McNichols Road • Detroit 12, Michigan

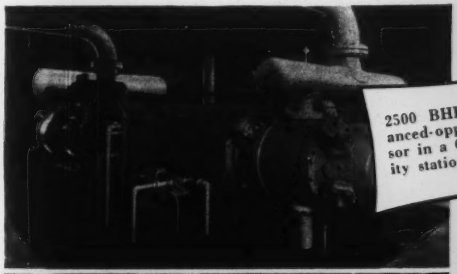
18 YEARS AGO...the first
TODAY...still the first!

Original installation on piling over Lake Maracaibo, Venezuela.

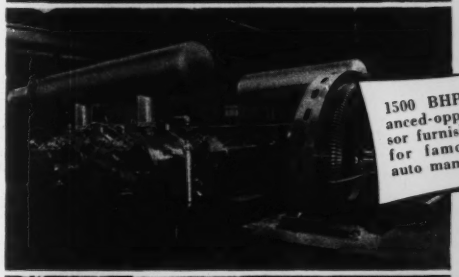
A Venezuelan oil producer ordered it, in 1932. The original heavy duty, balanced-opposed, motor-driven compressor. *A noteworthy Clark first!* And like 15 similar units added subsequently, it has delivered continuous, vibration-free service over the years.

In 1946 came a second major Clark development . . . a new line embodying components of the famous angle type compressor. Two, four and six-cylinder models in 8", 14" and 17" stroke sizes broadened the range to cover 150 to 4500 BHP.

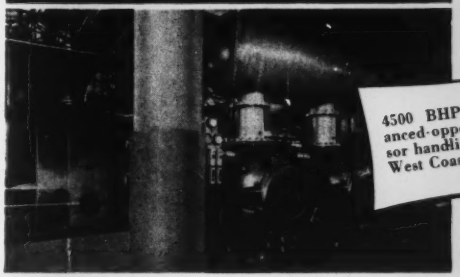
Today, Clark remains the pioneer, with continuing improvements in design and performance. *Data and illustrated catalog from your nearest Clark representative.*



2500 BHP, 4 cyl. balanced-opposed compressor in a California utility station.



1500 BHP, 4 cyl. balanced-opposed compressor furnishing plant air for famous Michigan auto manufacturer.



4500 BHP, 6 cyl. balanced-opposed compressor handling mfd. gas in West Coast utility plant.

SEE the difference in

CLARK®

balanced/opposed

MOTOR-DRIVEN COMPRESSORS

MIDGET ANGLE • RIGHT ANGLE • BIG ANGLE
ELECTRIC-DRIVEN • CENTRIFUGAL

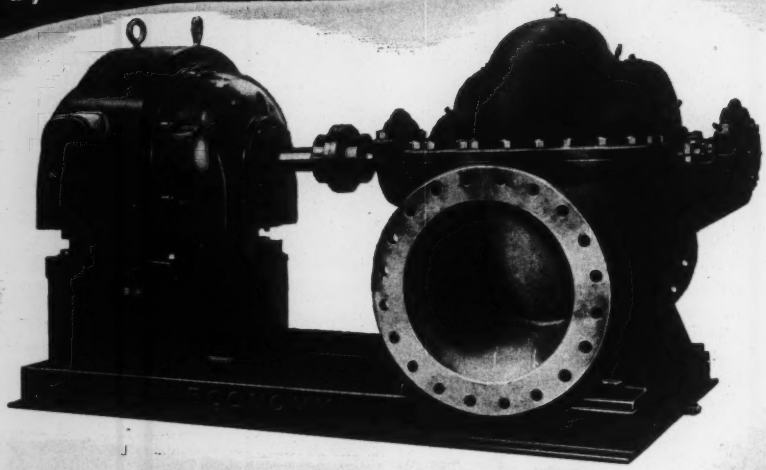
CLARK BROS. CO., INC.
OLEAN, N. Y.

One Of The Dresser Industries

New York • Tulsa • Houston • Chicago • Boston • Washington • Los Angeles • Birmingham • Detroit • Salt Lake City • San Francisco
London • Buenos Aires • Caracas, Venezuela • Paris • Lima, Peru • Bogota, Colombia • New Delhi, India

when it's pumps, think of Economy

backed by over thirty years of specialized experience



The Type M Single Stage Double Suction Pump illustrated is just one of the many in the extensive line manufactured by Economy Pumps, Inc. This exceptionally rugged design is available in capacities from 50 to 30,000 gallons per minute at heads to 300 feet. A general purpose pump, it is ideally suited to general water supply or heavy mill service.

Maintenance expense is held to a minimum. Case records show Economy Pumps operating for fifteen to twenty years without replacement of major parts. However, should repairs be necessary, all parts subject to wear are renewable.

Economy Pumps are tested in accordance with the standards of the Hydraulic Institute and the A. S. M. E. under conditions duplicating as nearly as possible those encountered in actual service.

Catalog No. A750 gives complete design and construction details, also some interesting typical examples of performance, as well as handy selection tables. Write Dept. CM-3 for your copy.

Economy Pumps Inc.

DIVISION OF HAMILTON-THOMAS CORP., HAMILTON, OHIO

Facts you should know about De Laval turbines!

This turbine has two traffic cops...

that give you double protection against overspeeding. The normal speed governor and overspeed governor are entirely separate. A sticky governor valve can't possibly jeopardize the operation of the overspeed governor and trip.

You can elect the governor that meets your requirements!

We have eight candidates for the job, so take your choice:

Mechanical Shaft governor with smooth-acting, long-wearing "rocking chair" action.

Vertical Mechanical governor geared to shaft for speeds above 4500 rpm.

Hydraulic Governor. Direct acting orifice-type for high speeds and/or wide range of speed adjustment.

Hydraulic Oil Relay for close regulation or for supplying extra power for valve movement.

Flyweight Oil Relay for close regulation such as encountered in synchronous generator drives.

Pressure Controls for constant pressure or differential pressure regulation of pumps, blowers, etc.

Speed Changers, manual or remote control by electric motor drive.

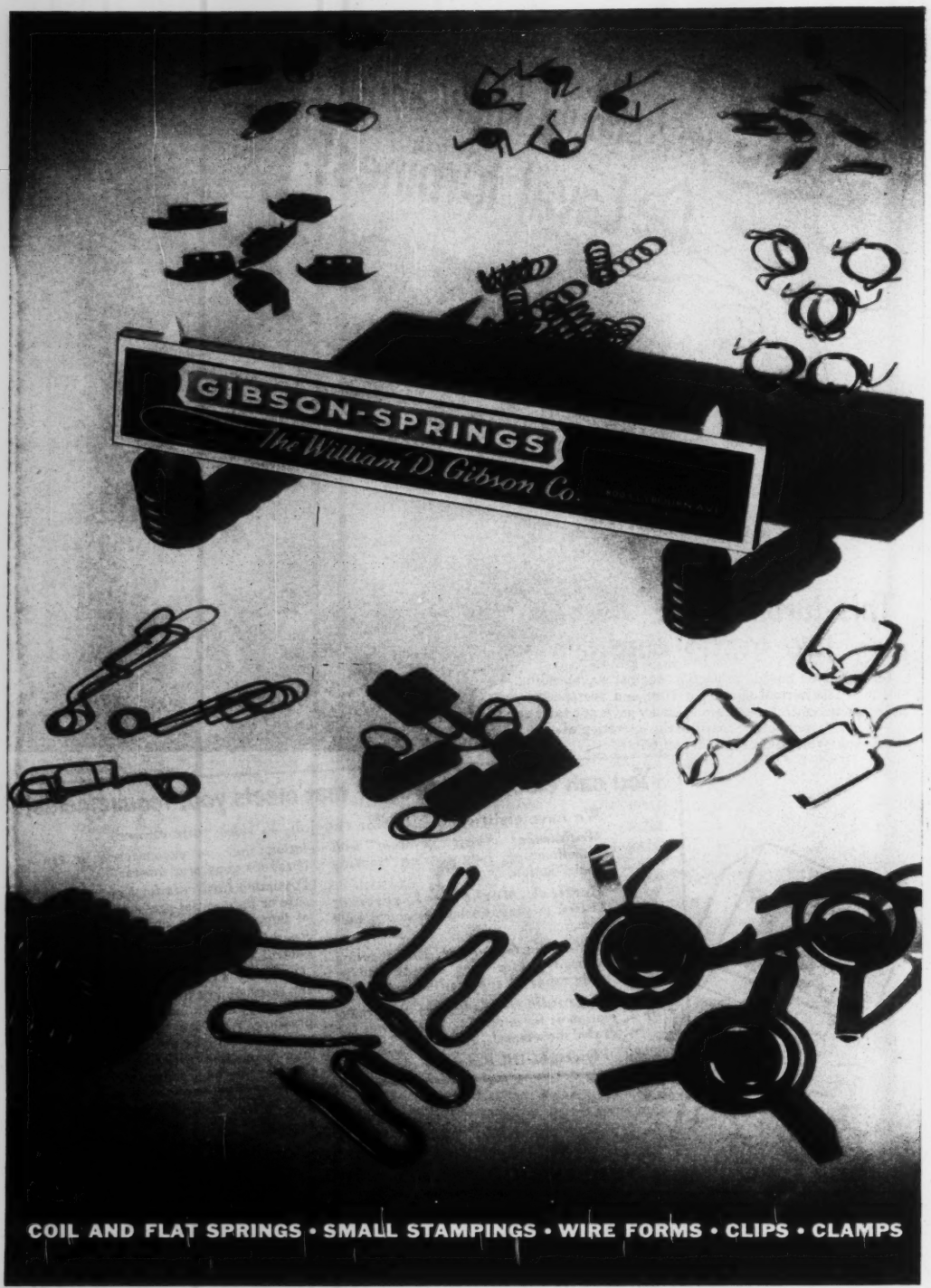
Auxiliary Trips to shut off steam in the event of low pressure in the lubrication system or undue rise of back pressure. Also can be solenoid operated for remote or manual trip, or for inter-connection with the driven machine or any emergency system.

Send for Catalog 82-19R

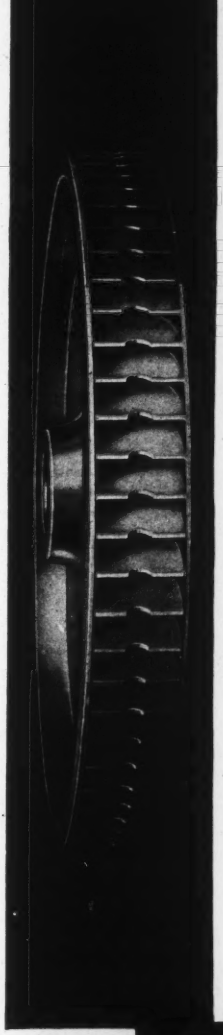
DE LAVAL STEAM TURBINE CO., TRENTON 2, N. J.

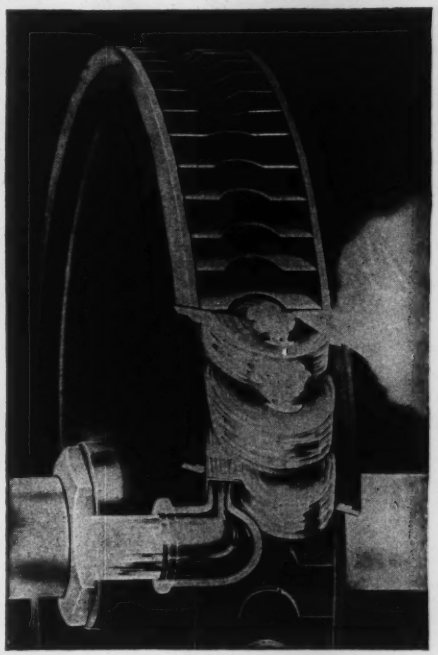
TURBINES • HELICAL GEARS • CENTRIFUGAL BLOWERS AND COMPRESSORS
CENTRIFUGAL PUMPS • WORM GEAR SPEED REDUCERS • IMO OIL PUMPS

50th DE LAVAL Anniversary


GIBSON-SPRINGS
The William D. Gibson Co.
COIL AND FLAT SPRINGS • SMALL STAMPINGS • WIRE FORMS • CLIPS • CLAMPS

TERRY





Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.

NO PARTS TO LOOSEN OR WORK OUT

The rotor of the Terry Wheel Turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to become loose or work out.

The power-producing action of the steam takes place on the solid curved backs of these buckets or pockets. Therefore close clearance is unnecessary and wear on the blades forming the pockets is of little consequence, as it does not materially affect horsepower or efficiency.

For detailed information about this effective construction and its advantages, write us on your business letterhead for a copy of Terry Turbine Bulletin S-116.

T-1172

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

THE All-New

MICROTOMIC

WHEN THEY Say 2H

...THEY Mean 2H!

If you have ever put down one 2H pencil . . . picked up another . . . and found it softer or harder than the first . . . it's time you discovered the meaning of absolute MICROTOMIC uniformity. Try the '3-Against-3' Test now! Newly developed quality controls keep all new MICROTOMIC leads of each degree identical!

EYE, TIME, WORK SAVERS

New Dusk Gray Color, choice of hundreds of draftsmen asked to pick most desirable color for a new drawing pencil. New 'bull's-eye' degree marking on 3 sides—makes the right pencil easier to find.

Smudge-Free Tracings...New MICROTOMIC leads are exceptionally free of loose graphite particles that cause smudges! New Hi-Density Wood-clinched leads—stronger, tougher than ever!

Clearer Prints, because MICROTOMIC new Hi-Density lines are exceptionally opaque to the actinic rays of high-speed 'printers'. Result... *dead-white* lines, without feathering or blurry edges!

free! TRY THE "3-against-3" test

Mail the coupon for 3 FREE New MICROTOMIC Drawing Pencils. Test them for uniformity against your present pencils. *You can't miss the difference...mail now!*

EBERHARD FABER PENCIL COMPANY, DEPT. ME-1,
37 GREENPOINT AVENUE, BROOKLYN 22, N. Y.

Send me 3 New MICROTOMIC Drawing Pencils FREE. I'll test their uniformity against my present pencils. Degree..... *(specify only one)*

Name.....

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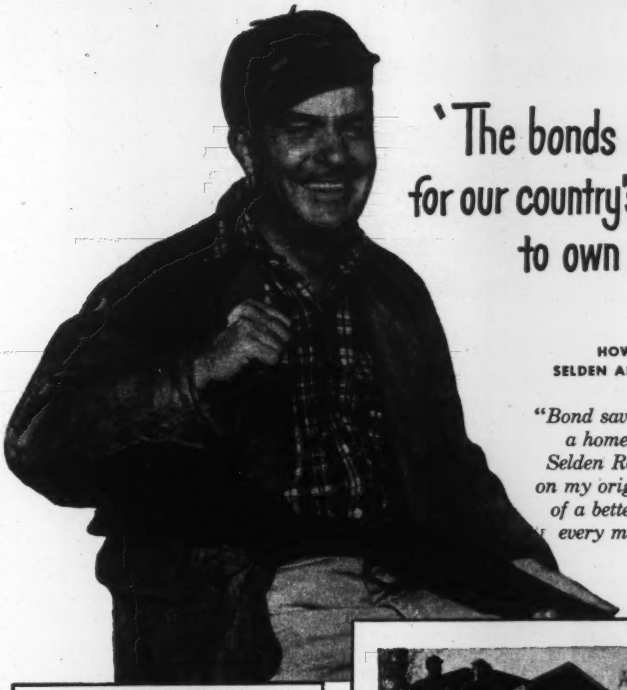
City..... *State*.....

EBERHARD FABER

TRADE MARKS REG. U. S. PAT. OFF.



"The bonds Lila and I bought for our country's defense helped us to own our own home!"

HOW U. S. SAVINGS BONDS PAID OFF FOR SELDEN AND LILA ROBINSON OF DENVER, COLORADO

"Bond saving made it possible for me to become a home owner," says engineer-sportsman Selden Robinson, "then helped me to improve on my original investment through the purchase of a better home. My story should encourage every man who dreams of a house of his own."

"We started our bond buying program before the war, purchasing two $18.75 bonds a month through the Payroll Savings Plan at the Stearns-Roger Manufacturing Co. When war came, we gave up our dream home for the duration and were glad our bonds went for our country's victory."

"Bonds paid $2800 down on a house in 1945. They provided $500 toward a new car. And this year when we traded our first house for a new brick one, bonds paid the difference. We had the money only because of our systematic bond buying program."

"We've saved $4,000, and now we're buying bonds toward a college education for our two daughters, Emily, 15 and Carol, 8. There's no surer savings program than Payroll Savings and U. S. Savings Bonds which are backed by the greatest nation on earth!"

The Robinsons' story can be your story, too!

You can make your dream come true, too—just as the Robinsons did. It's easy! Just start *now* with these three simple steps:

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Select Your Steel Valves

Edward GAGE VALVES 600 lb sp

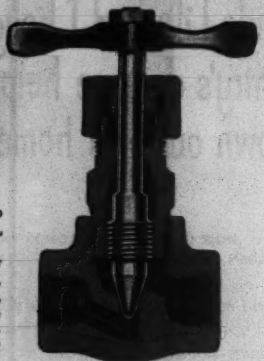


Fig. 152

FIG. 152 SERIES—A drop forged, instead of bar stock, steel valve for gage, meter, dead-end, instrument and other small lines, and for pumps, vents, Diesel and gas engines, etc. Long taper semi-needle type stem-disk for close regulation and tight seating. Fig. 152 series has carbon steel body with EValloy 13% chrome stem-disk. Fig. 2152 series, all 13% chromium stainless steel. Fig. 4152 series, all 18-8 stainless steel.

Screwed Ends—Globe or Angle

Size Range—⅛", ¼", ⅜", ½", ¾" and 1"

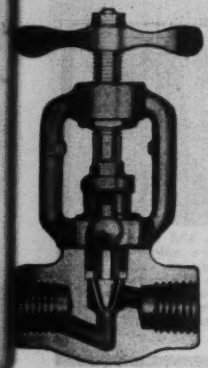


Fig. 952

Edward INSTRUMENT VALVES 1500 lb sp

FIG. 952 SERIES—A compact, heavy-duty valve for instrument panels, regulators, orifice meters, by-pass lines, oil field gage or instrument services, corrosive lines, etc. Drop forged steel body and yoke. No possibility of bonnet joint leakage. Swing bolted gland. Fig. 952 series valves have carbon steel body with EValloy 13% chromium stainless steel trim. Fig. 2952 series has EValloy stainless steel body and trim.

Screwed or Socket Welding Ends—O. S. & Y.—Globe or Angle

Size Range—¼", ⅜", ½"

Edward Globe & Angle Valves 600-1500 lb sp

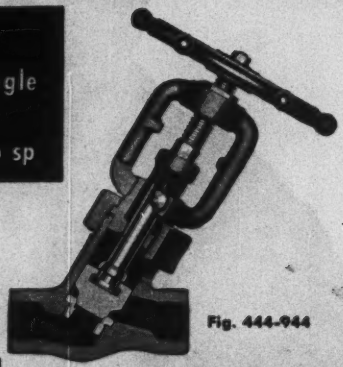


Fig. 444-944

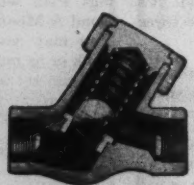
FIG. 444-944 SERIES—All purpose valves, ideal for nearly any service where O. S. & Y. small forged steel valves are used. Streamlined, low-pressure loss body and bonnet both forged steel. Built with union bonnet in sizes 1" and smaller for 600 lb sp, and in sizes ¾" and smaller for 1500 lb sp. Larger sizes in both pressure classes have bolted bonnet joint. Bronze bushed yoke, simplified bolted gland design for easy packing adjustment, EValpak high pressure-high temperature die-molded packing, and inclined stem design for free flow and minimized turbulence are standard features. Easy to repack, with both hands free to insert packing. Stem, disk and seat hardened EValloy 13% chromium stainless steel regularly furnished; Stellite hard-faced seat and disk available on order.

Fig. 448-948

Screwed or Socket Welding Ends—O. S. & Y —Globe or Angle

Size Range—¼", ⅜", ½", ¾", 1", 1¼", 1½" and 2"

Edward CHECK VALVES 600-1500 lb sp



WIDE CHOICE

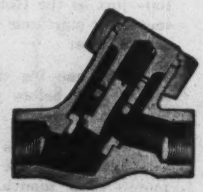
Edward forged steel check valves are built in ball or piston types, with union or bolted bonnets, with screwed, socket welding or flanged ends. Available for installation in either horizontal or vertical lines.

BALL CHECKS

Ideal for viscous fluid service. Spring loaded, fully guided ball disk is stainless steel, as is the mated seat.

Screwed or Socket Welding Ends—Horizontal or Vertical.

Size Range—¼", ⅜", ½", ¾", 1", 1¼", 1½" and 2".

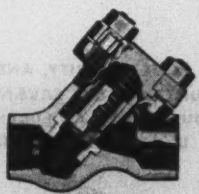


PISTON CHECKS

General service small check valves that give freedom from shock or excessive vibration, yet seat quickly and tightly upon flow reversal.

Screwed, Socket Welding or Flanged Ends—Horizontal or Vertical.

Size Range—¼", ⅜", ½", ¾", 1", 1¼", 1½" and 2".



BOLTED COVER CHECKS

Either ball or piston types, in variations of body style and end connections for boiler feedline or general process services.

Screwed, Socket Welding or Flanged Ends—Horizontal, Vertical or Angle.

Size Range—½", ¾", 1", 1¼", 1½" and 2".

From New Edward Designs

These are among the many new Edward designs. The Edward steel valve line is never static. From a development department devoting its time exclusively to the problems of temperature, pressure and other operating conditions usually associated with the use of steel valves, have come—through the years—literally hundreds of design and material innovations. Many Edward features have become industry standards; others are still exclusive with Edward. The new designs described briefly here are ideally suited for the service conditions of today's power plant, petroleum, industrial and technological installations.

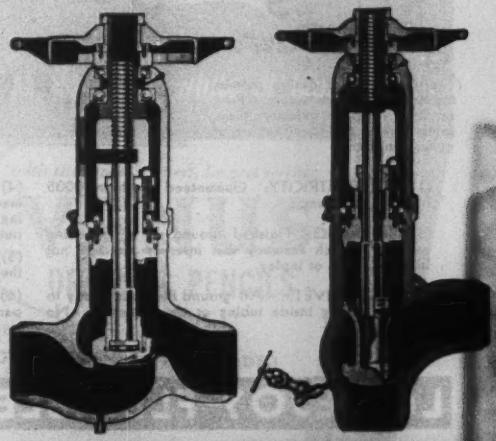
Fig. 2224

Edward
Welded Bonnet
UNIVALVES
1500 - 2500 lb sp

FIG. 2224 SERIES—Welded bonnet, inclined stem forged steel globe valves. Integral Stellited seat and disk construction, perfect alignment between body and bonnet, contoured for least resistance to flow and to cut wear-producing erosion. Bonnet joint leakage forever eliminated. Forged chromium-molybdenum bodies. Impactor handle available on larger sizes. Fig. 2224 series for 1500 lb service; Fig. 3924 for 2500 lb sp.

Socket Welding Ends—Globe Type

Size Range—½", ¾", 1¼", 1½" and 2"



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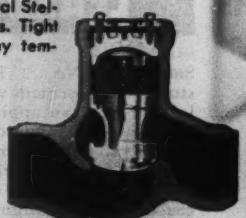
900-1500-2500 lb sp

GLOBE AND ANGLE STOP, NON-RETURNS, CHECKS—Newest design pressure-seal bonnet valves in globe or angle stop or non-return and horizontal or angle check valves. Many features are Edward "firsts"—Impactor handwheels, EValthrust yoke bushings, Equalizers, streamlined flow passages, etc. Regularly built with integral Stellited seats and Stellited disks. Tight bonnet-joint connection at any temperature, low maintenance, easy disassembly, proven materials for top temperatures and reduced weight are among the features. All types in either 900, 1500 or 2500 lb sp classes.



Size Range—2½, 3", 4", 5", 6", 8", 10", 12" and 14".

Edward
BLOW-OFF
VALVES
300-600
1500 lb sp

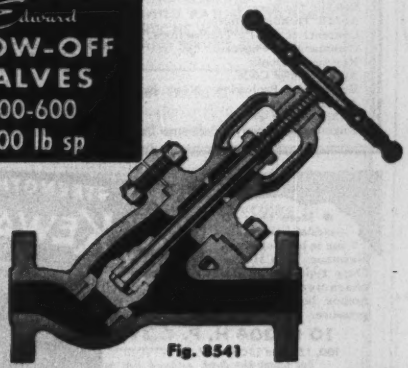


Fig. 8541

FULL RANGE—Edward cast and forged steel blow-off valves, in straightway or angle patterns, meet all standards for blow-off valve service, and give complete flexibility in working piping hook-ups for any space limitation. Slow-opening type so that damaging shock to piping is eliminated.

Flanged or Socket Welding Ends — Straightway or Angle

Size Range—1½", 2" and 2½".

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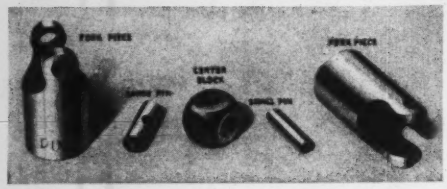

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February, 1951 CARD INDEX Vol. 73, No. 2

The Industrial Status of Ductile Iron, A. P. Gagnebin	107
Glass as a Coating for Steel, W. G. Martin	109
National Income and Economic Policy, R. L. Bishop	114
Heat-Pump Installations for Residential Use, E. R. Ambrose	115
The Developing Critical Shortage of Engineers, S. C. Hollister	121
Some Design Aspects of Metal-Powder Parts, D. C. Bradley	123
Grinding Fluids—Characteristics and Applications, H. W. Wagner	128
Editorial	99
Briefing the Record	133
ASME Technical Digest	147
Contents of ASME Transactions	154
Comments on Papers	155
Reviews of Books	159
ASME Boiler Code	161
Engineering Profession—News, Notes	166
ASME News	176
ASME Junior Forum	179
Engineering Societies Personnel Service	180

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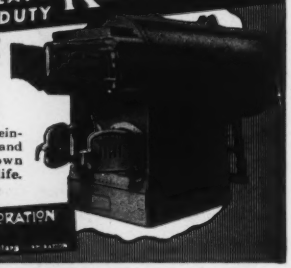

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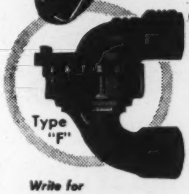

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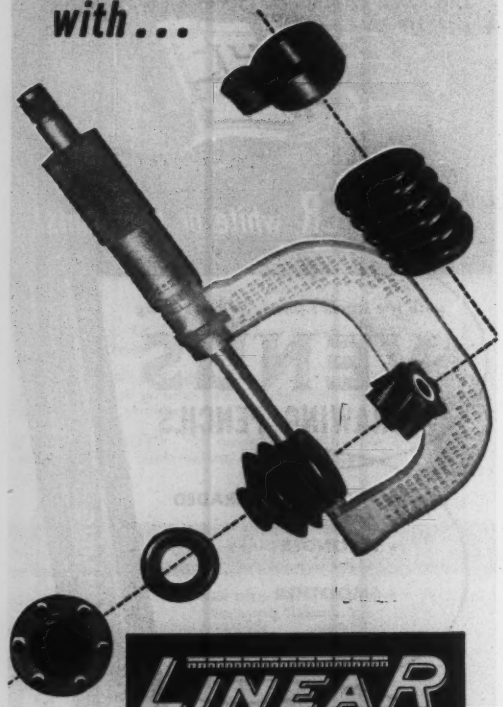

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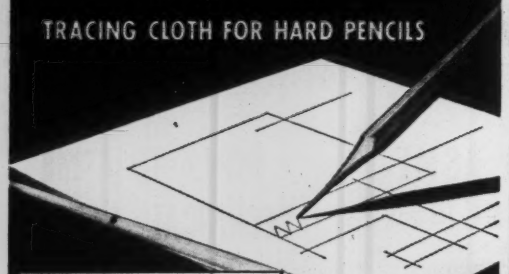

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Ultimate tensile strength lbs. per sq. in.		(Minimums)				
Sand Cast	125,000	115,000	108,000	100,000	90,000	85,000
Rolled 1" and under	.....	120,000	110,000	105,000	95,000	85,000
Rolled or Forged, over 1"	.....	115,000	108,000	100,000	90,000	85,000
Yield Point (divider method)						
Sand Cast	95,000	75,000	60,000	55,000	45,000	40,000
Rolled 1" and under	.....	75,000	65,000	60,000	50,000	45,000
Rolled or Forged, over 1"	.....	75,000	65,000	60,000	50,000	45,000
Elongation in 2"—%						
Sand Cast	10	12	14	15	20	25
Forged or Rolled	.....	12	13		15	20
Reduction in area—%						
Sand Cast	.....	12	14	15	20	25
Forged or Rolled	.....	12	13		15	20
COMPRESSION						
Yield Point—lbs. per sq. in.	70,000	65,000	58,000	50,000	40,000	35,000
Permanent Set at 100,000 lbs. per sq. in. (max.)	.015	.020	.030	.050	.080	.125
Brinell hardness, No.	250	240	220	200	175	150

List of U. S. Government Specifications Covering HY-TEN-SL Bronze

ARMY
Forgings, Rolled Rod QQ-B-721 Class B
Castings...QQ-B-726 Class B and C

NAVY
Forgings and Rolled Rod 46B15d Class B
Castings, Aluminum-manganese Bronze 46B29

WATERTOWN and OTHER ARMY ARSENALS
Castings WXS-5
Forgings and Rolled Rod.....WXS-2

NAVAL GUN FACTORY
Washington Navy Yard
Castings—Trunnion Metal.....O.S.530

AIRCRAFT
See Navy and Army (above).

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This is a review of the steps involved in the manufacture and classifications of lubricating oils—particularly their use in internal combustion engines of the Diesel type; the methods of testing new and used oils, the general significance of the different test methods; and of the factors and principles of fluid film lubrication and their engineering application.

Published, 1949 **$1.50***

DIESEL FUEL OILS

In the first of the three comprehensive articles in this publication the theory of distillation and method by which separation is accomplished in the fractionating column is explained. The complexity of a modern oil refinery is dealt with. Residuals, thermal reforming, alkylation, isomerization of butane, polymerization of propylene, mercaptan removal and other elements of a modern oil refinery are described clearly.

The second article reviews the chemical compounds present in Diesel fuels, gives their chemical properties, and shows how these properties control the characteristics of the composite fuel mixture. Fuel impurities are dealt with and there is a discussion of present and future Diesel fuels from standpoint of cost, availability, and use of additives.

The concluding article covers such main topics as mixture formation, kinetics of reactions, mechanism of auto-ignition, physical and chemical factors affecting ignition delay, fuel properties affecting ignition delay, mechanism of inflammation, factors affecting rate of reaction during inflammation, reaction velocity in relation to Diesel knock, products of incomplete combustion, and combustion calculations based on chemical stoichiometry. Supporting the text is a bibliography of sixty-one items.

Published, 1948 **$3.50***

PROCEEDINGS OF THE 21st NATIONAL OIL AND GAS POWER CONFERENCE

DYNAMIC ANALYSIS OF VALVE SPRINGS AND VIBRATIONS IN VALVE MECHANISMS

These two papers form an excellent treatise on dynamics in valve mechanism. Methods of analysis are given that practical engineers will find both effective and simple to use. Equations for natural frequency of helical springs are included as well as a complete set of the calculations necessary to design a lift curve.

EFFECT OF CYLINDER PRESSURE RISE ON ENGINE VIBRATIONS

In studying papers on this subject the author noted many controversies between the opinions of various authors in their search for a suitable measure for judging the pressure-time (p-t curve), in its effect on the generation of vibration. It is the object of this paper first to settle these controversies on a required measure and second to project those fundamental features that may contribute to a better understanding of experimental results and to form a basis for experimental study.

TWO-CYCLE DUAL-FUEL DIESEL ENGINE WITH AUTOMATIC FUEL CONVERSION

This paper deals with the developments of a two-cycle 8 1/2 x 11 1/2 Dual-Fuel engine; discusses how it differs from the Diesel combustion-wise as well as the differences in mechanical make-up; and reports on features of operation, performance data, and field results.

Published December, 1950

DIESEL LOCOMOTIVE ENGINE COOLING SYSTEMS

This consideration of an important auxiliary on the Diesel electric road locomotive includes radiator application, general design of the core, the fan and the three different fundamental schemes of radiator fans drive now in use, and a comparison of these schemes for economy of engine power used.

IGNITION SYSTEM FOR OIL ENGINES

This article describes a variation from the conventional spark ignition system that is giving excellent results. It also describes tests on solid fuel injection engines with this ignition system and presents the results and possibilities indicated thereby.

A TRAINING PROGRAM FOR RAILROAD PERSONNEL

Anyone preparing a training program will find this article extremely helpful. It deals with some of the problems encountered in developing a suitable program for instructing railway men in the construction, operation and maintenance of Diesel electrical locomotives.

DIESEL-ENGINE MAINTENANCE INSTRUCTION, ALCO V-TYPE ENGINE

This paper shows the procedure used in instructing railroad personnel in Diesel engine construction and maintenance used in Diesel electric locomotives. Special emphasis is placed on the design of the engine which features (1) interchangeability of wearing parts; (2) accessability to all parts; (3) light parts which permit easy handling; (4) supercharging, which gives ample horsepower in a comparatively small and light engine.

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THE FIRST FIFTY YEARS OF THE DIESEL ENGINE IN AMERICA

Reviews historical development of the large modern Diesel in America; traces the evolution of the high speed Diesel engine in America from the inception of development work on relatively small high-speed engines to the present state of the art; summarizes some of the important factors responsible for progress in large Diesel development; and interpret research developments of the Diesel and newer reciprocating heat engines.

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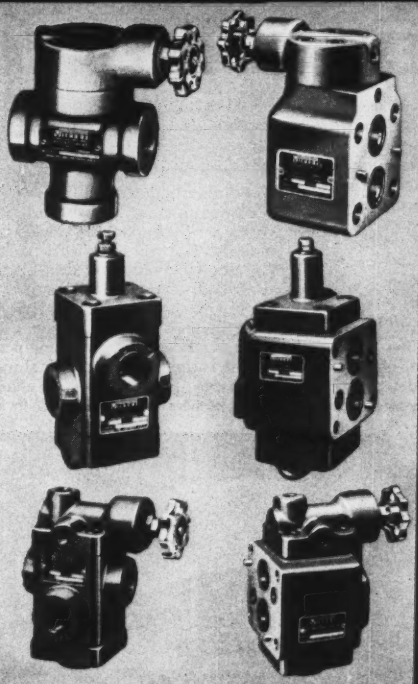
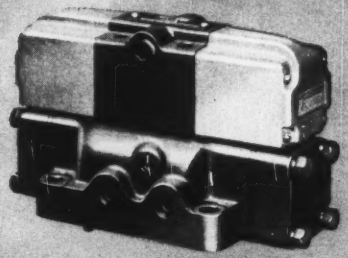


Vickers maximum pressure (relief) valves, pressure reducing valves, and sequence valves are constructed to limit maximum pressure adjustments within nominal working pressure range. Wires and seals can be used after final adjustment for locking.



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Shown at the left are representative Vickers Valves that comply with J.I.C. Standards. These valves embody proven design and construction features that provide dependability, greater accessibility for maintenance, simplification of piping and reduced installation costs. For further information ask for Catalog 5000.

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

3558

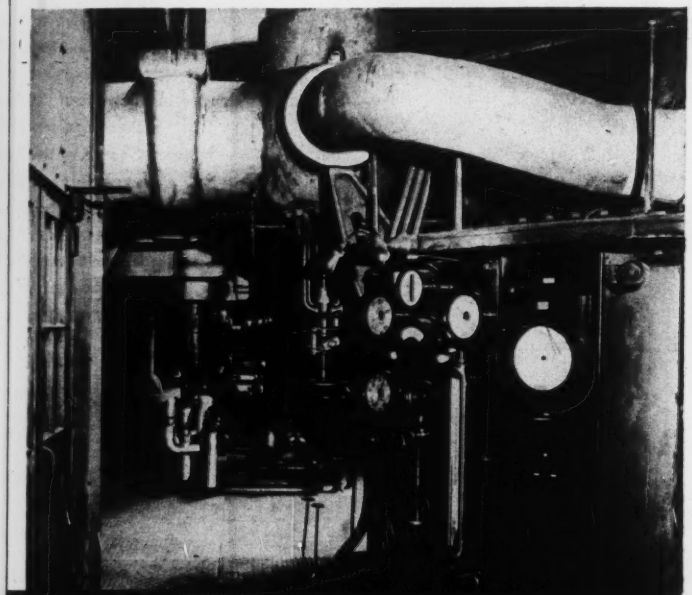
News

SK HIGH PRESSURE VALVES FACE LIFE AT 40

For almost 40 years, three SK Inverted Turbine Throttle Valves have been performing efficiently with minimum maintenance at the Schuylkill Station of the Philadelphia Electric Company. They are still going strong. When the valves were installed, force for tripping was based on a differential area closing piston. Today, SK Valves of modern design are provided with springs for tripping.

The particular valve shown in the close-up, one of the three, has a 14″ inlet and two 10″ outlets. It is located on the steam header to a 14,000 KW Turbine and passes 325,000 lbs. per hour of steam at 220 psi. Each of the three valves serves one turbine.

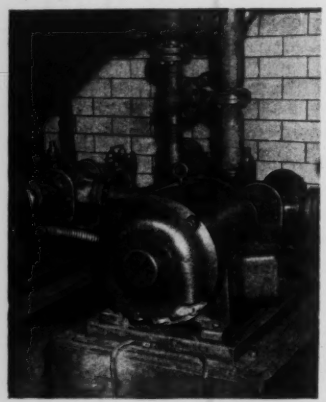
This long-life installation is typical of SK equipment. Over the years, we have accumulated a file of testimonials from SK customers satisfied with the efficiency and durability of SK Valves. We feel this justifies the SK policy that equipment, designed and built, not to meet a price, but to perform efficiently over a long period of time is the most economical in the long run. There are SK Valves to meet *your* needs. *Write for Bulletin 8-D.*



Manufacturing Engineers

Efficiency and Economy
Keynotes of SK Gear Pumps

Rugged pumping problems dictate soundly engineered pumps constructed of durable materials to insure long life and minimum maintenance. SK Gear Pumps are just that! Take for example this New England power plant installation. The two pump



sets pictured are each required to handle 40 gpm of No. 6 fuel oil at 860 rpm against 230 psi. Since the day they were installed, these pumps have built up an impressive continuing record for efficient and economical operation.

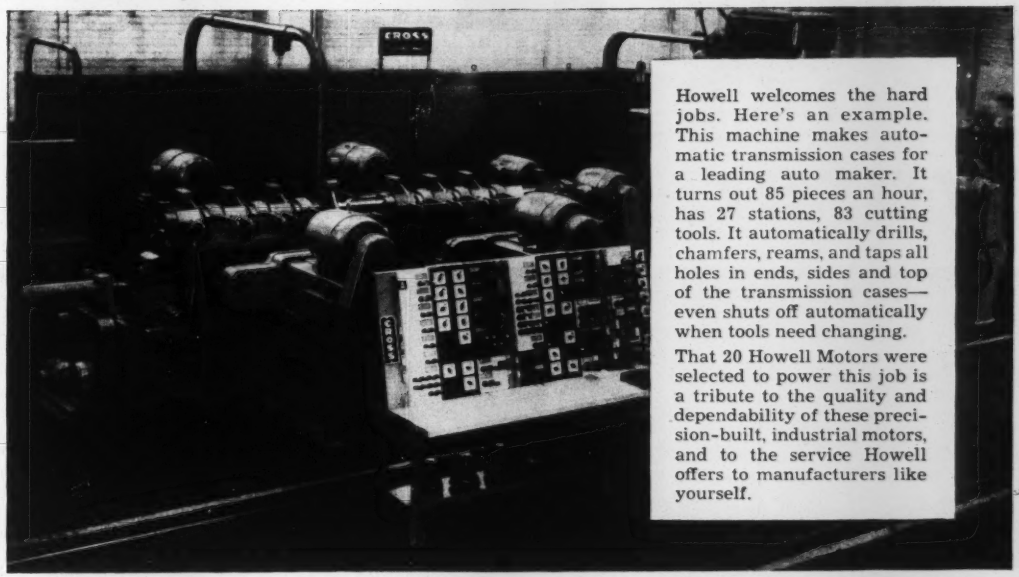
Built in any practical material, SK Gear Pumps will handle liquid free from solids in capacities up to 1000 gpm, and pressure to 3500 psi.

Schutte and Koerting Company maintain high standards of quality in all Gear Pumps by the strictest supervision of each step in the manufacturing process.

Whatever your pumping requirements, investigate SK Gear Pumps which are available from stock. Write for Bulletin 17-A.

SK ROTAMETER BULLETIN

SK Bulletin 18-RA lists the various types and applications of SK Rotameters. *Request your copy.*

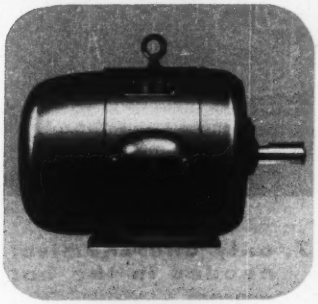


Howell welcomes the hard jobs. Here's an example. This machine makes automatic transmission cases for a leading auto maker. It turns out 85 pieces an hour, has 27 stations, 83 cutting tools. It automatically drills, chamfers, reams, and taps all holes in ends, sides and top of the transmission cases—even shuts off automatically when tools need changing.

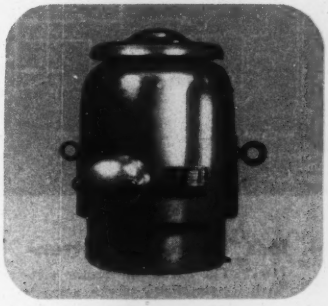
That 20 Howell Motors were selected to power this job is a tribute to the quality and dependability of these precision-built, industrial motors, and to the service Howell offers to manufacturers like yourself.

Solution for . . .

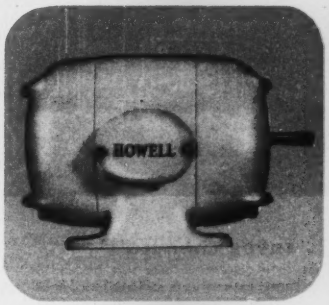
THE CASE OF AN AUTOMATIC TRANSMISSION



Howell Type K Motor. Offers constant performance in the presence of dirt, dust, fumes, and moisture. Sizes from 3 to 150 H.P. at 1800 R.P.M. Either vertical or horizontal mounting.



Howell makes specially designed motors—vertical, round body, flange and face mounting, built-in stator and rotor jobs, etc.—to meet a wide range of requirements.



Howell Sanitary Motors meet the most exacting standards of the dairy and food industries. They contain no pockets, cracks, or crevices. Available for vertical or horizontal mounting.

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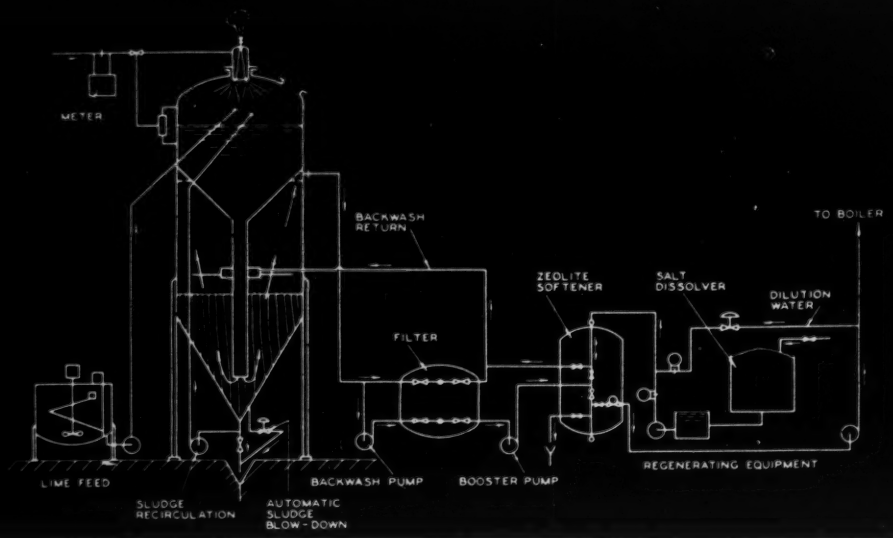
cochrane hot process zeolite water conditioner



1. saves chemicals
The zeolite softener uses salt instead of the more expensive soda ash and phosphates, bringing down the cost of chemicals considerably.

2. saves on capital investment The cost of adding zeolite equipment to a hot process installation is far less than the addition of an independent sedimentation tank and chemical feed for a two-stage phosphate process.

3. lower CO_2 in steam
The lower alkalinity resulting from using lime alone plus the fact that this alkalinity is all carbonate, causes a reduction in CO_2 generated in the steam.

4. less operating attention The use of the zeolite softener with its simplicity of operation is an advantage which is enhanced by the longer periods between regenerations, due to the lower hardness of the hot process softener effluent.

5. less floor space and head room required
The addition of the zeolite equipment requires less floor space and less head room than that required for two stage phosphate equipment.

6. lower alkalinity The use of lime (or Dolomitic lime) as the sole reagent in the hot process means that the alkalinity can be reduced to about half that obtained with lime and soda ash.

7. only one chemical needed in the hot process It is generally possible to use a single reagent in the hot process, namely lime or Dolomitic lime, precipitating the bicarbonates and magnesium, leaving the remaining hardness to be removed by the more economical zeolite.

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Continued on Page 104

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Six Pages of "OPPORTUNITIES" This Month . . . 103-108

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BS in Mechanical Engineering with a major in Mechanics or Mathematics, with at least two (2) years' experience in this field will be required.

Mechanical Designers needed for mechanical design work in the field of production. The problems are varied sometimes requiring electrical equipment so that a broad knowledge of design is required. Will consider Trade School Graduate or equivalent, with two (2) years of machine design and/or design drafting of production items. Would prefer a background of two (2) years of college with four (4) years or more of machine design experience.

Must have an understanding of machine shop practices and some knowledge of time study. Must be able to produce on the board complete design layouts.

Mechanical Designers needed for mechanical design of small equipment. The problems are varied in nature so that a broad knowledge of design is required.

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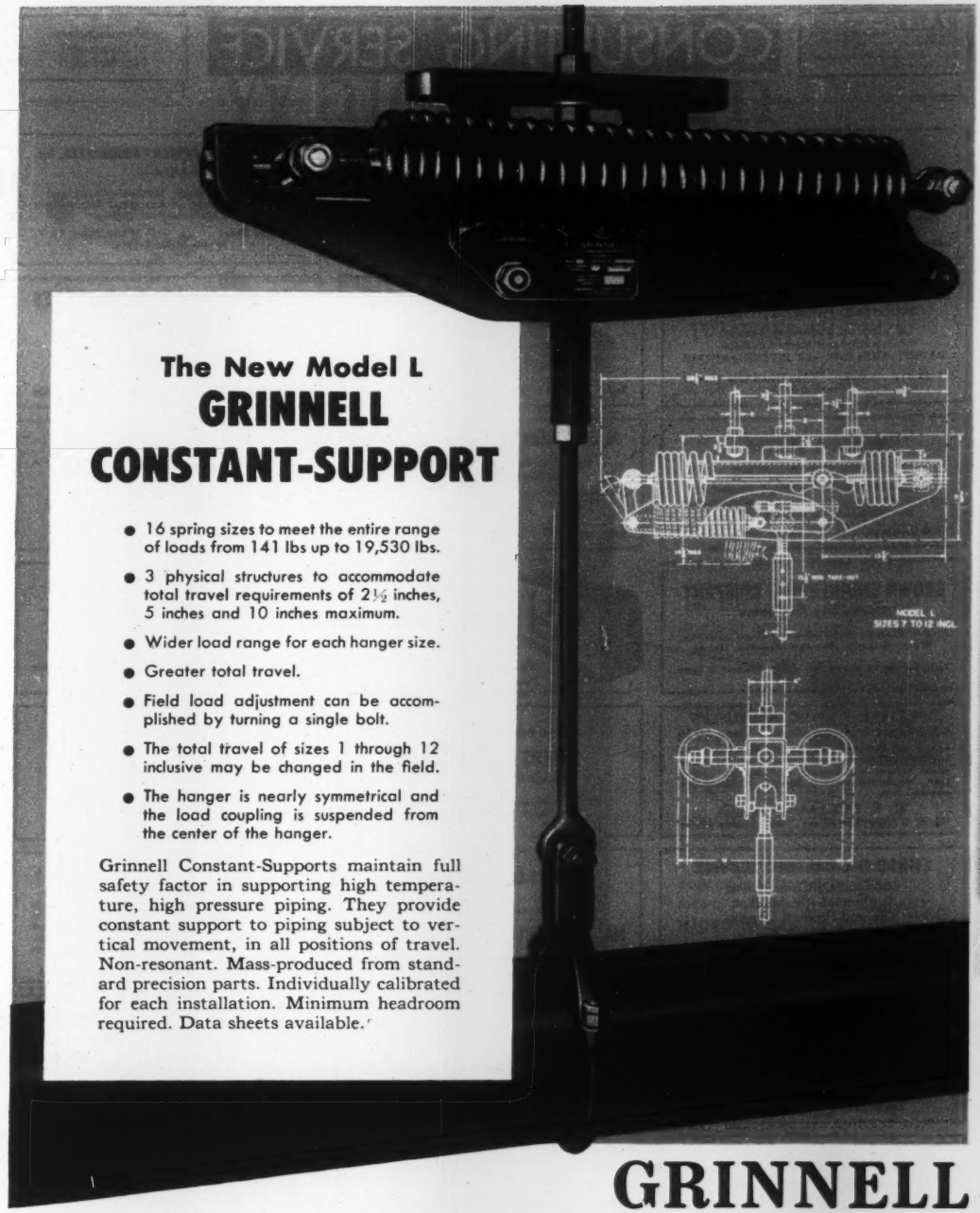

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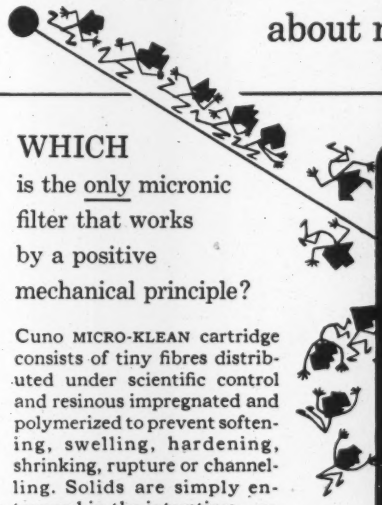

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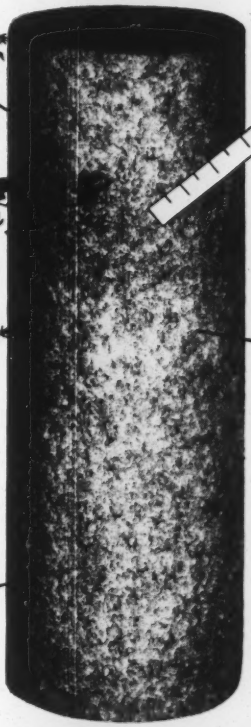

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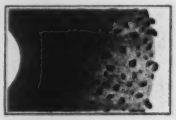

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Index To Advertisers

*Air Preheater Corp. 28
*Allis-Chalmers Mfg. Co. 31
*American Blower Corp. 18
American Cladmetals Co. 57
*American Manganese Bronze Co. 96
American Pencil Co. 93
*American Pulverizer Co. 59
ASME Publications 95, 98
Amplex Mfg. Co.
Sub. of Chrysler Corp. 7
*Armstrong Machine Works
3rd Cover
Aurora Pump Co. 63

*Bailey Meter Co. 2nd Cover
*Barco Mfg. Co. 56
*Barnes, Wallace, Co.
Div. Assoc. Spring Corp. 79
Blaw-Knox Div.,
Blaw-Knox Co. 68
Boston Gear Works 64, 65
Bruning, Charles, Co. 55
Brush Development Co. 30
*Buffalo Forge Co. 81
Bundy Tubing Co. 33

Carborundum Co. 26, 27
Centriline Corp. 62
Chace, W. M., Co. 61
Clarage Fan Co. 114
Clark Bros. Co. 83
Clark Equipment Co.
Industrial Truck Div. 60
Cleveland Worm & Gear Co. 39
Climax Molybdenum Co. 51
*Cochrane Corp. 102
*Combustion Engineering-
Superheater (Inc.) 113
Cone-Drive Gears Div.,
Michigan Tool Co. 82
Consolidated Engineering Corp. 94
Cuno Engineering Corp. 111

*DeLaval Steam Turbine Co. 85
*Detroit Stoker Co. 80
Dow Corning Corp. 42

Eagle Pencil Co. 73
Eastman Kodak Co. 75
Economy Pumps (Inc.)
Div. Hamilton-Thomas Corp. 84

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Edward Valves (Inc.)
Sub. Rockwell Mfg. Co. 90, 91
*Erie City Iron Works 77

Faber, Eberhard, Pencil Co. 88
Fafnir Bearing Co. 70
Flexo Supply Co. 93
*Foxboro Co. 97

*General Electric Co. 4, 5
*Gibson, Wm. D., Co.,
Div. Assoc. Spring Corp. 86
Graphite Metallising Corp. 51
*Grinnell Co. 109

Hamilton-Thomas Corp. 84
Hathaway Instrument Co. 67
Helicoid Gage Div.,
American Chain & Cable Co. 58
Henschel, John, & Co. 59
Howell Electric Motors Co. 101

Imperial Tracing Cloth 96
International Nickel Co. 34
Iron Fireman Mfg. Co. 3
Irving Subway Grating Co. 50

Jenkins Bros. 40
*Johnson, Carlyle, Machine Co. 10

*Kewanee Boiler Corp. 92
*Koppers Co. (Inc.)
Fast's Coupling Dept. 19
Kunkle Valve Co. 108

*Ladish Co. 17
Ledeen Mfg. Co. 67
Linear (Inc.) 94
*Link-Belt Co. 2
Lovejoy Flexible Coupling Co. 92
Lukens Steel Co. 11

MB Manufacturing Co. 14
Mercoid Corp. 50
*Miniature Precision Bearings 96
Morse Chain Co. 8, 9

*National Airoil Burner Co. 96
New Departure, Div.
General Motors Corp. 1
Nice Ball Bearing Co. 16

*Oilgear Co. 21
O'Neil-Irwin Mfg. Co. 43

*Pangborn Corp. 54
*Peabody Engineering Corp. 53
Permutit Co. 24
Philadelphia Gear Works 29
Physicists Research Co. 52
Posey Iron Works 15

*R-S Products Corp. 32
Revere Copper & Brass (Inc.) 74
*Ric-Wil Co. 63
Rockford Clutch Div. of
Borg-Warner Corp. 96
*Roots-Connersville Blower
Corp. 37

*S K F Industries (Inc.) 71
*Sarco Co. 12
*Schutte & Koerting Co. 100
Smith, Winfield H., Corp. 49
Smooth-On Mfg. Co. 92
Sponge Rubber Products Co. 20
Standard Pressed Steel Co. 48
*Standard Stoker Co. 46
Streeter-Amet Co. 68
Stuart, D. A., Oil Co. 66

*Taylor Forge & Pipe Works 72
*Terry Steam Turbine Co. 87
Thomas Flexible Coupling Co. 50
*Timken-Detroit Axle Co.,
TDA Brake Div. 22, 23
*Timken Roller Bearing Co.,
4th Cover
Universal Drafting Machines
Corp. 47

Vickers (Inc.) 99
*Vogt, Henry, Machine Co. 76

Walworth Co. 6
Westinghouse Electric Corp. 69
White, S.S., Dental Mfg. Co.
Industrial Div. 44
Whitney Chain Co. 78
*Wickes Boiler Co., Div. of
Wickes Corp. 25
*Wing, L. J., Mfg. Co. 45
Wolverine Tube Div., Calumet
& Hecla Cons. Copper Co. 13

*Yarnall-Waring Co. 35

CONSULTING SERVICE . . . Page 110

Armstrong, Cecil W., & Assoc.
Barnard, S. Bertrand
Black & Veatch
Brown Engineering Co.
Coleman, W. B. & Co.
Ehrco Die Casting Service
Fries, Peter, Jr.
Hathaway, C. M.
Kendall, George H.
Lancaster, Allwine & Rommel
MB Design Consultants (Inc.)
Mast Development Co.
Myers & Addington
National Weld Testing Bureau
Nuclear Development Assoc.
Palmer, Delos M., Assoc.
Polachek, Z. H.
Sanderson & Porter
Sargent & Lundy
Sirrine, J. E., Co.
Stanley Engineering Co.
Tour, Sam, & Co.

Advertisers in previous 1951 issues but not in this issue

*Aetna Ball & Roller Bearing Co.
All American Tool & Mfg. Co.
Allegheny Ludlum Steel Corp.
*American Brass Co.
*American Felt Co.
Arkwright Finishing Co.
Automotive & Aircraft Div.,
American Chain & Cable Co.

*Babcock & Wilcox Co.
Baldwin-Duckworth Div. of
Chain Belt Co.
Barksdale Valves
*Barnes-Gibson-Raymond,
Div. Assoc. Spring Corp.
Bell Telephone Laboratories
Bridgeport Thermostat Div.,
Robertshaw-Fulton Controls
Co.
Briggs & Stratton Corp.
Brown & Sharpe Mfg. Co.
*Brownell Co.
Byron Jackson Co.

Carrier Corp.
Chain Belt Co.
Chiksan Co.

Diamond Chain Co. (Inc.)
*Downingtown Iron Works
Dravo Corp.
Drop Forging Association
Du Mont, Allen B., Labs.

Earle Gear & Machine Co.
Elliott Mfg. Co.
*Engineer Co.
*Farrell-Birmingham Co.
Farval Corp.
Fenwal (Inc.)
*Foster Wheeler Corp.
Fulton Sylphon Div.,
Robertshaw-Fulton Controls
Co.

*Garlock Packing Co.
*Gear Specialties (Inc.)
General Radio Co.
*Goulds Pumps (Inc.)

*Hamilton Mfg. Co.
Hyatt Bearings Div.,
General Motors Corp.
Hydropress (Inc.)

International Exposition Co.
*James, D. O. Gear Mfg. Co.
*Johns-Manville
Johnson, S. T., Co.
*Jones, W. A., Foundry & Machine Co.

Kellogg, M. W., Co.
Keuffel & Esser Co.
Klipfel Valves (Inc.) Div.
Hamilton-Thomas Corp.

Lincoln Electric Co.
Lubriplate Div.,
Fiske Bros. Refining Co.
Lunkenheimer Co.

*Mears-Kane-Ofeldt (Inc.)
Midwest Piping & Supply Co.

Niagara Blower Co.
Nordstrom Valve Div. of
Rockwell Mfg. Co.
Northern Blower Co.
Ohio Injector Co.
Petro-Chem Development Co.
*Republic Flow Meters Co.
Research Corp.
Robertshaw-Fulton Controls Co.

Sier-Bath Gear & Pump Co.
Spraying Systems Co.
*Taylor Instrument Cos.
Tri-Lok Co.
*Tube Turns (Inc.)

*Voss, J. H. H., Co.

*Western Gear Works
Wisconsin Motor Corp.
Wollensak Optical Co.

MECHANICAL ENGINEERING, 29 W. 39th St., New York 18, N. Y.

Additional information is requested on the following advertisements in the March 1951 issue.

Page No.	*Name of Advertiser*
_____	_____
_____	_____
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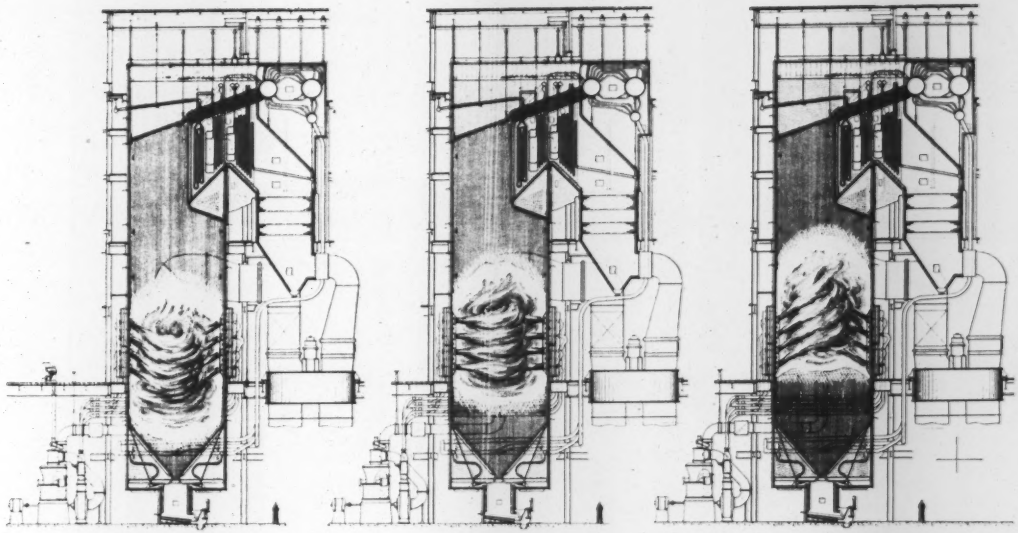
Reader Service Coupon For More Information

Go through the advertising pages and jot down the page numbers and names of advertisers about whose product you want additional information — mail the coupon to us — your request will be passed on to the advertiser promptly — you will hear directly from advertiser — saves your time in writing individual letters.



Advantages of the C-E Tilting Tangential Burner

The combination of tangential firing and the Tilting Burner accomplishes certain highly important results beyond the reach of any other burner or firing method presently available. These are:

1. Control of the temperature of furnace gases at the furnace exit which permits:
   - *(a) Control of steam temperatures over a wide range.*
   - *(b) Minimum use of desuperheating spray.*
   - *(c) Use of wide variety of coals.*
   - *(d) Accurate proportioning of superheater and reheater surfaces.*
   - *(e) Lower air heater maintenance.*
2. Substantial control over slagging conditions which results in:
   - *(a) More uniform furnace conditions.*
   - *(b) Better heat absorption.*
   - *(c) Minimum use of soot blowers.*

Recognition of the importance of these advantages throughout the utility industry is evidenced by the fact that more than 90 per cent of the C-E boiler capacity ordered by utilities in 1950 will be equipped with C-E Tilting Burners.

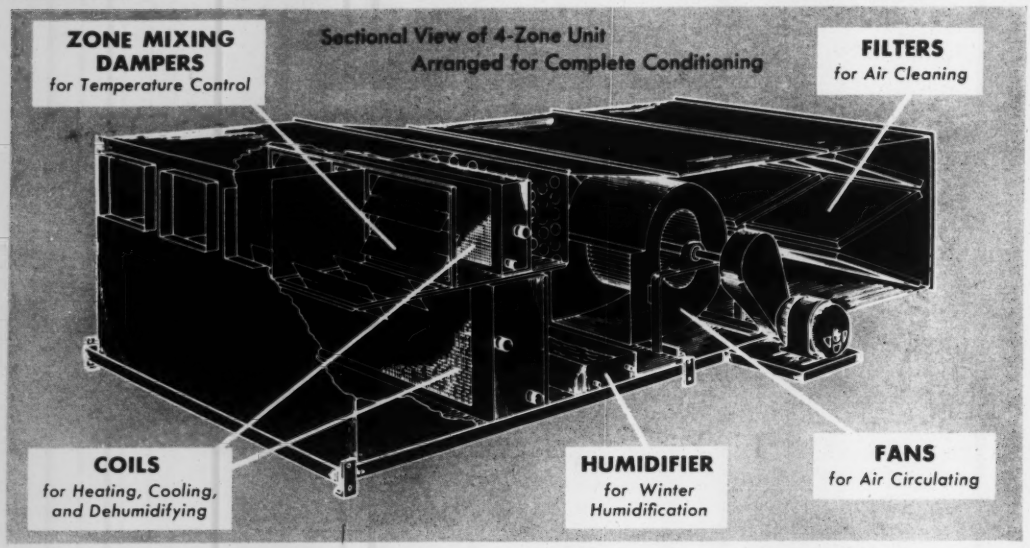
B-464

COMBUSTION ENGINEERING — SUPERHEATER, INC.

200 Madison Avenue • New York 16, N. Y.

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

Blow-Thru MULTITHERMS



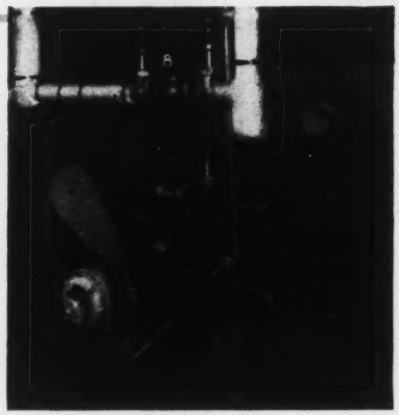
for ZONE CONTROL *Air Conditioning*

Different Temperatures and Humidities at the SAME Time with ONE Unit

One Clarage Blow-Thru Multitherm can be used to air condition various parts of your building exactly as your requirements warrant.

ZONE CONTROL compensates for the difference in solar radiation on different parts of a building during different times of the day. It also takes into account variations of exposure, wind velocity, construction, and different internal heat loads.

Thus winter and summer, if desired, you can maintain *different temperatures and different humidities* in various parts of your building. Each zone is automatically and independently controlled — yet only ONE Clarage Blow-Thru Multitherm required.



This 3-zone Blow-Thru Multitherm unit air conditions the 2-story office building of the Northern Indiana Brass Co., Elkhart, Indiana. Installation made in December, 1940.

CLARAGE
—HEADQUARTERS for Air Handling and Conditioning Equipment

NEW BULLETIN 1310 gives descriptive details, specifications, capacities, and dimensions. Send for your free copy today.

CLARAGE FAN COMPANY
KALAMAZOO, MICHIGAN

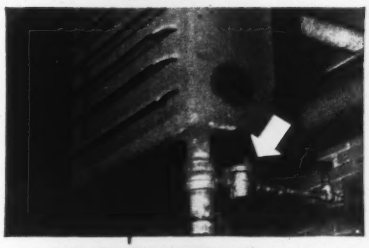
APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

A STEAM TRAP MECHANISM GOOD FOR 900°F, 950 PSIG

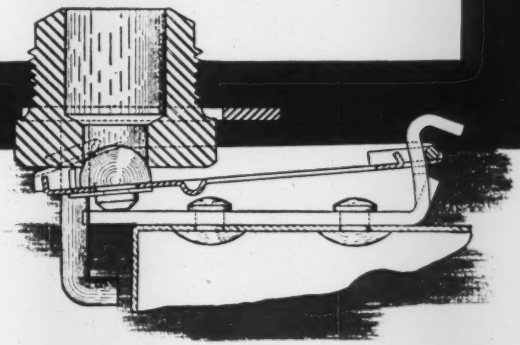
. . . will last a long time on low and medium pressures

THESE ARMSTRONG USERS KNOW

"TRAPS OPERATE 4 TO 5 YEARS WITHOUT REPAIRS." . . . Weymouth Art Leather Co., South Braintree, Mass.



"50% LESS TRAP MAINTENANCE since installing Armstrongs on low pressure vacuum return heating system." . . . John Deere Ottumwa Works, Ottumwa, Iowa.



THE valve and seat in *every* Armstrong Inverted Bucket Steam Trap are chrome steel — hardened, ground and lapped to a steam-tight fit. The valve lever assembly and the bucket are corrosion resistant 18-8 stainless. You get the same design, workmanship and materials whether you order traps for a low pressure heating application or for a high pressure power plant application. *In other words, you get the longest-lasting, most trouble-free trap that money can buy at no premium in price.* If you think you'd like that, call your nearby Armstrong Representative for the traps you need now.

ARMSTRONG MACHINE WORKS
894 Maple Street • Three Rivers, Michigan

SEE OUR CATALOG IN SWEET'S

FACTS, FIGURES, PRICES

and complete data on trap sizing are contained in the 36-page STEAM TRAP BOOK. Send for your copy.

ARMSTRONG STEAM TRAPS

10 new features—31 TIMKEN® bearings in new Kearney & Trecker milling machine

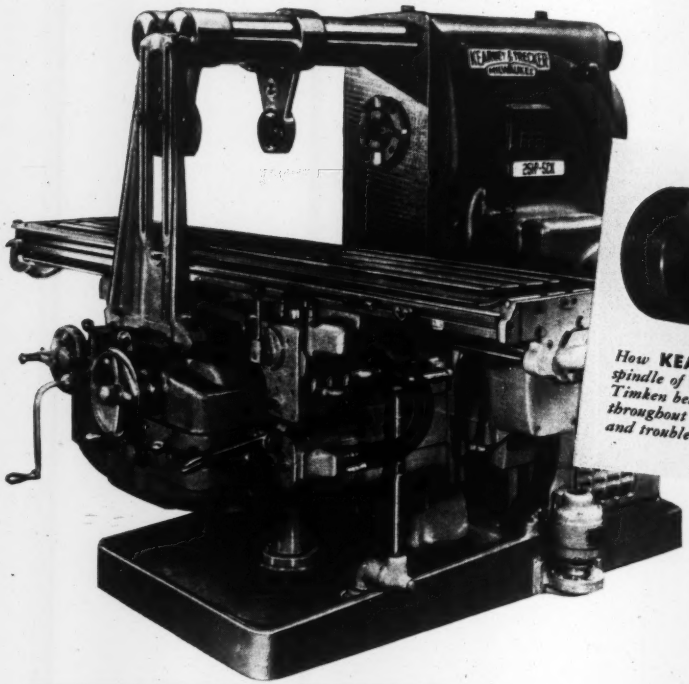
THE new Kearney & Trecker Model "CK" Milling Machine shown below has 10 outstanding new features, ranging from non-glare rapid-set dials to a new and heavier solid-back, sponson design column. And throughout the spindle assembly, feed drive gear box and speed train gear box, there are 31 Timken® bearings to insure greater rigidity, lasting precision and long, trouble-free operation in this new knee-type milling machine.

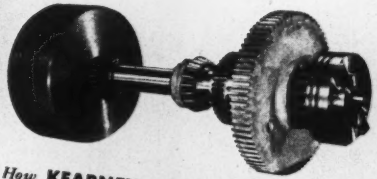
Because of their tapered construction, Timken bearings carry any combination of radial and thrust loads. In the gear boxes, Timken bearings help prevent wear by holding gears and shafts in positive alignment. On the three-bearing spindle, Timken bearings insure long-lasting precision, and permit pre-loading to any desired degree.

Made of Timken fine alloy steel—the finest ever developed for tapered roller bearings—rollers and races have case-hardened, wear-resistant surfaces and tough, shock-resistant cores. Line contact between rollers and races gives extra load-carrying capacity. True rolling motion and incredibly smooth surface finish practically eliminate friction.

Remember, no other bearing can give you *all* the advantages you get with Timken bearings. They're backed by 50 years of bearing research and development and are first choice throughout industry. Whether you build or buy machine tools, insist on bearings with the trade-mark "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.





How **KEARNEY & TRECKER** *mount the spindle of their new "CK" milling machine on Timken bearings. 31 Timken bearings are used throughout to insure extreme accuracy, long life and trouble-free service.*

IT'S TIMKEN BEARINGS FOR VALUE!

To get the best value in bearings you may find this simple formula helpful:

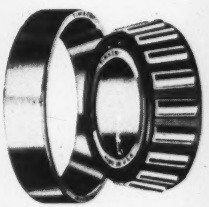
$$Value = \frac{quality + service + public\ acceptance}{price}$$

Obviously a big advantage *above* the line gives you more value than a small one *below*. No other bearing can match the uniform high quality, engineering and field service and overwhelming public acceptance you get with Timken bearings.

TIMKEN

TRADE MARK REG. U.S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▱ BEARING TAKES RADIAL ◫ AND THRUST ⊣◫⊢ LOADS OR ANY COMBINATION ✳